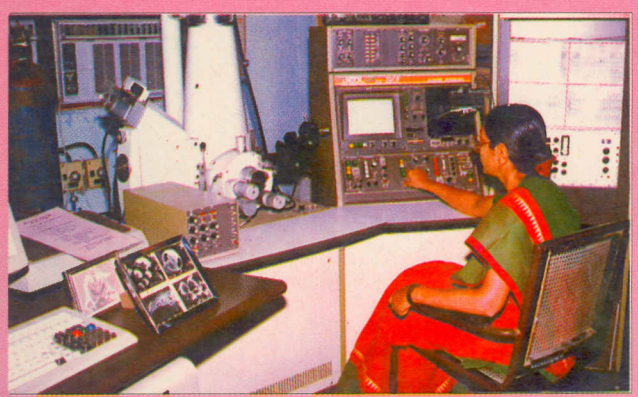
ANNUAL REPORT

1995-96

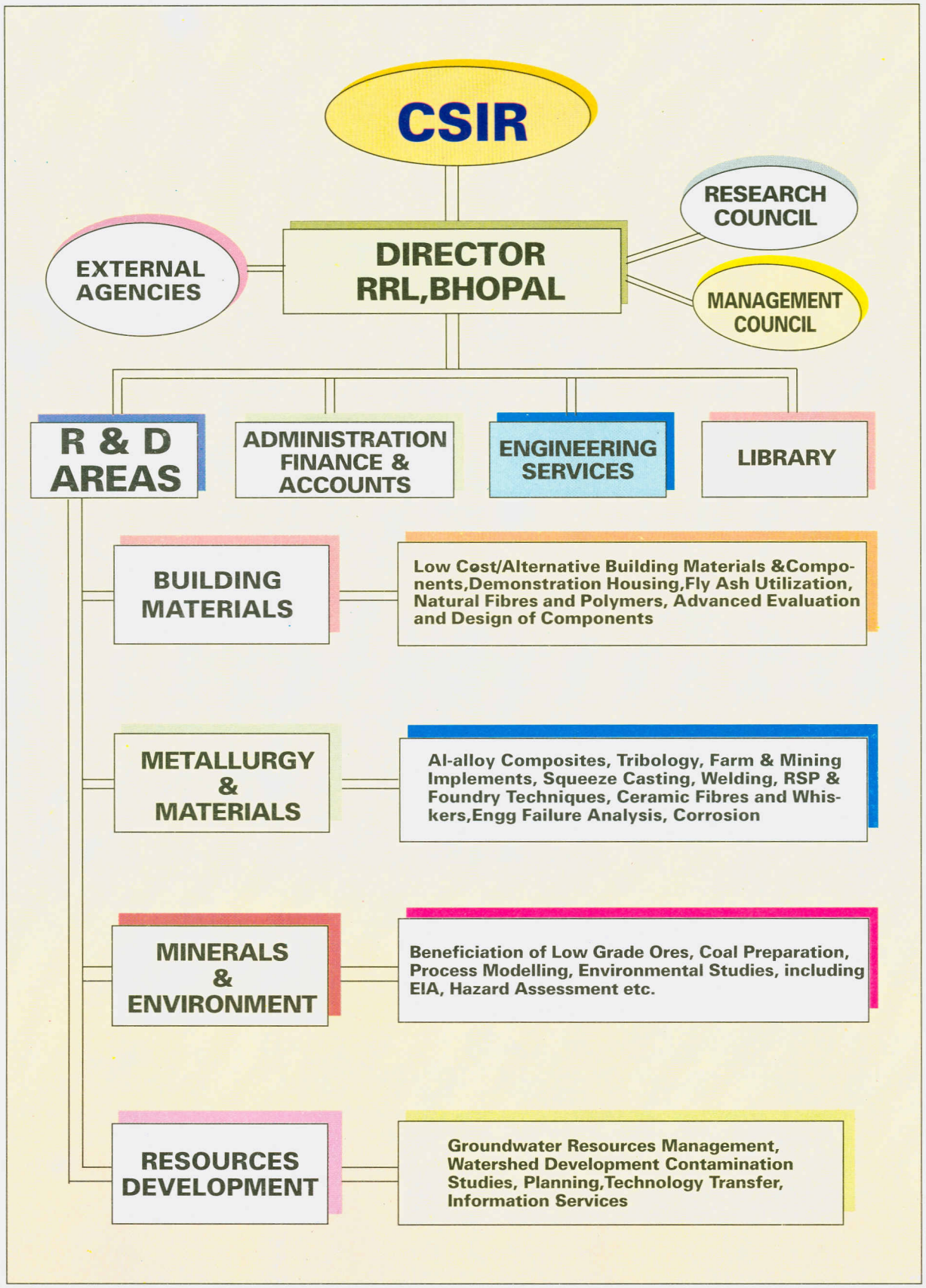


REGIONAL
RESEARCH
LABORATORY
BHOPAL

LIST OF ABBREVIATIONS USED

AACL	Atlas Automotive Components Limited
AERB	Atomic Energy Regulation Board
BHEL	Bharat Heavy Electricals Limited
BMTPC	Building Materials Technology Promotion Council
BZL	Bharat Zinc Limited
CBIP	Central Board of Irrigation and Power
CGWB	Central Ground Water Board
CIAE	Central Institute of Agricultural Engineering
CMPDIL	Central Mine Planning and Design Institute Limited
CPWD	Central Public Works Department
CSIR	Council of Scientific and Industrial Research
DAE	Department of Atomic Energy
DMRL	Defence Metallurgical Research Laboratory
DST	Department of Science and Technology
HUDCO	Housing and Urban Development Corporation
HZL	Hindustan Zinc Limited
IBM	Indian Bureau of Mines
ICAR	Indian Council of Agricultural Research
IISc	Indian Institute of Science, Bangalore
ISM	Indian School of Mines, Dhanbad
ISRO	Indian Space Research Organisation
MPSIC	M.P. State Industries Corporation
NABARD	National Bank for Agricultural and Rural Development
NALCO	National Aluminium Company Limited
NBO	National Building Organisation
NFL	National Fertilizers Limited
NMDC	National Mineral Development Corporation
NTPC	National Thermal Power Corporation
OCL	Orient Cerwool Limited
OTL	Optel Telecommunications Limited
MOUD	Ministry of Urban Development
MPCOST	M.P. Council of Science & Technology
MPSMC	M.P. State Mining Corporation
PHED	Public Health Engineering Department
PWL	Permali Wallace Limited
RDSO	Railways Design and Standards Organisation
RGMWD	Rajiv Gandhi Mission for Watershed Development
RRL	Regional Research Laboratory, Bhopal
SECL	South Eastern Coal Fields Limited
TADA	Tawa Ayacut Development Authority
TISCO	Tata Iron & Steel Company
VRDE	Vehicle Research & Development Establishment

ORGANISATION CHART



Director's Report

It is a great privilege to present the Annual Report 1995-96 of Regional Research Laboratory, Bhopal. This period has seen the laboratory respond to new environs spelt through CSIR vision and strategies. Foremost amongst significant efforts have been in terms of attracting externally funded projects and assignments. Thus, it has been possible to generate external cash flow of Rs.198.28 lakh during the year (Rs.132.8 lakh, 1994-95).

An important trend has shown up through consolidation of R&D efforts in areas like fly ash utilization, water resources management, metal matrix composite materials where the earlier projects and results have led to larger and specific assignments. It has surely facilitated a sharper focus in the R&D endeavour. Two licenses have been given for the manufacture of R-wood, the wood substitutes products. RRL developed high strength, light weight and corrosion proof fibre reinforced plastic (FRP) gear cases for traction motors of diesel locomotives of Indian Railways. After over fifteen months trials FRP gear cases were dismantled and nothing adverse was reported. Minor repairs were done and the gear cases are once again back on the locomotive.

During 1995-96 RRL aimed at excellence in specialised technical advice and services like environmental impact assessment (EIA) studies failure investigation and remnant life extension in thermal power plant components, trouble shooting and analysis in mineral and coal beneficiation processes, evaluation of building materials and components.

Similarly, the aspirations of providing support to regional S&T needs led to more guided and visible efforts. M.P. State Govt. has launched Rajiv Gandhi S&T Missions programmes in watershed management under the Rajiv Gandhi S&T Mission of M.P. State Govt. and National Drinking Water Mission respectively have evoked a lasting interest. RRL has also facilitated and coordinated interactions amongst other R&D institutions and M.P. State agencies. The laboratory is working with National Leather Mission, and Rajiv Gandhi S&T Mission on Rural Industries for environmental impact assessment studies. In view of regional needs, specialised services on EIA, risk assessment and such other areas are being developed by the laboratory.

The scientific community has been encouraged for participation in seminars, interaction with external agencies, presentation of research results in internal seminars and joining prestigious professional societies. Scientists have been deputed for visits abroad. RRL had visits by eminent Scientists,

Researchers and Technologists, which provided opportunities of high technical and academic interactions. Dr. G.S. Siddhu, Ex-DGSIR delivered the CSIR Foundation Day (1995) address.

Many functional additions were made to the existing S&T infrastructure, particularly with a view to modernise and update the facilities. Several modifications in the laboratory buildings for additional space have been completed. Construction of residential colony in the campus, horticulture and afforestation are in progress.

RRL records sincere appreciation of the support received from various Govt. deptts., agencies and industry who have sponsored significant R&D projects. A close interaction with them has ushered in an era of meaningful R&D collaboration.

RRL, Bhopal is especially indebted to Dr. P. Rama Rao, Chairman, Research Council, Dr. S.K. Joshi, Ex-Director General, CSIR, Dr. R.A. Mashelkar, Director General, CSIR, Members of Research Council and Management Council for providing directions to the R&D endeavour. The guidance received from CSIR Headquarters has been very valuable to us. The laboratory received precious technical and financial support from Building Materials Technology Promotion Council, for which special thanks are due to Dr. T.N. Gupta, Executive Director.

A close interaction with the State S&T Missions, M.P. Council of Science & Technology and other agencies was possible due to guidance and support received from Dr. Ram Prasad, Director General, MPCOST. Excellent cooperation and help received from Rajiv Gandhi S&T Mission Directorates of M.P. State Govt. is gratefully acknowledged.

Scientists and staff of RRL, Bhopal have put in hard and dedicated work towards development and progress of the laboratory.

(T.C. RAO)
Director

निदेशक का प्रतिवेदन

क्षेत्रीय अनुसंधान प्रयोगशाला, भोपाल की वर्ष 1995-96 का वार्षिक प्रतिवेदन प्रस्तुत करना एक विशेषाधिकार है। इस अवधि में प्रयोगशाला ने वै औ अ प के समवलोकन और रणनीतियों द्वारा समर्थित नये परिवेश में काम किया, वाह्य रूप से निधिवद्ध परियोजनाओं और अनुवंधों को आकर्षित करने के लिए विशेष प्रयास किए गए। इस प्रकार, इस वर्ष के दौरान रु. 198.28 लाख का वाह्य कैश फ्लो अर्जित करना संभव हुआ है।

फ्लाई ऐश उपयोग, जल स्रोत प्रवंधन, धात्विक आधात्री सम्मिश्र (मेटल मैट्रिक्स कम्पोजिट) पदार्थों के क्षेत्र में पूर्व परियोजनाओं और परिणामों से वड़े और विशेष अनुवंध प्राप्त हुए। इससे निश्चय ही अनुसंधान और विकास उद्यम में एक सुस्पष्ट लक्ष्य निर्धारित हुआ है। आर-काष्ठ और काष्ठ व्युत्पन्न उत्पादों के निर्माण के लिए दो लाइसेंस दिए गए। क्षे अ प्र ने भारतीय रेलवे के डीजल इंजनों के कर्षण मोटरों के लिए, हल्के उच्चशक्ति, और संक्षालक साधित रेशा प्रवलित प्लास्टिक (फाइवर रेन्फोर्स्ड प्लास्टिक) गियर केस विकसित किए । पन्द्रह महीनों के परीक्षणों के वाद इनको इंजन से उतारा गया और कुछ भी प्रतिकूल नहीं पाया गया। अल्प सुधार किये गए गियर केस एक वार फिर इंजन में स्थापित किए गए।

वर्ष 1995-96 के दौरान क्षे अ प्र का उद्देश्य था पर्यावरण प्रभाव निर्धारण (ई आई ए) अध्ययन विफलता जांच और तापीय ऊर्जा संयंत्र घटकों में शेष जीवन विस्तार, खनिज एवं कोयला अपचयन प्रकियाओं का विश्लेषण, इमारती पदार्थों और घटकों का मूल्यांकन जैसी सेवाओं और विशेषीकृत तकनीकी सलाह में विशेष योग्यता प्राप्त करना।

इसी प्रकार, क्षेत्रीय अनुसंधान एवं विकास आवश्यकताओं में सहायता प्रदान करने की आकांक्षाओं के फलस्वरूप अधिक निर्देशित और स्पष्ट प्रयास किए गए। मध्य प्रदेश राज्य सरकार के राजीव गांधी अनुसंधान एवं विकास मिशन के अन्तर्गत मध्य प्रदेश राज्य सरकार ने जल-ग्रहण प्रवंधन में राजीव गांधी अनुसंधान एवं विकास मिशन और राष्ट्रीय पेय जल मिशन ने स्थायी रूचि उत्पन्न की। क्षे अ प्र ने अन्य अनुसंधान एवं विकास संस्थानों और म प्र राज्य संगठनों के वीच सामंजस्य स्थापित करने में सहायता की। प्रयोगशाला राष्ट्रीय चमड़ा मिशन और राजीव गांधी ग्रामोद्योग मिशन के साथ मिल कर पर्यावरण प्रभाव निर्धारण अध्ययनों पर काम कर रही है। क्षेत्रीय आवश्यकताओं को ध्यान में रखते हुए, ई आई ए, दायित्व निर्धारण तथा अन्य ऐसे क्षेत्रों में प्रयोगशाला ने विशेषीकृत सेवाएं आरंभ की हैं।

वैज्ञानिक समुदाय को सेमीनार, वाह्य एजेन्सियों के साथ परस्पर संवाद, भीतरी सेमीनारों में शोध परिणामों के प्रदर्शन और प्रतिष्ठित व्यावसायिक संगठनों का सदस्य वनने के लिए प्रेरित किया गया। वैज्ञानिकों को विदेश भेजा गया। अनेक प्रतिष्ठित वैज्ञानिकों ने क्षे अ प्र का दौरा किया। डा. जी. एस. सिद्धू, पूर्व महानिदेशक, वै औ अ प ने वै औ अ प स्थापना दिवस(1995) व्याख्यान दिया।

शोधकर्ताओं और प्रौद्योगिकीविदों को उच्च तकनीकी और अकादमी परस्पर संवाद के अवसर प्रदान किए गए।

विशेष रूप से सुविधाओं को आधुनिकतम और अद्यतन वनाने के उद्देश्य से वर्तमान अनुसंधान एवं विकास संरचना में अनेक क्रियात्मक परिवर्तन किए गए। प्रयोगशाला भवन में अतिरिक्त स्थान वनाने के लिए अनेक रूपांतरण पूरे किए गए। परिसर में रिहायशी कालोनी का निर्माण, वागवानी और वनरोपण का कार्य प्रगति पर है।

विशिष्ट अनुसंधान एवं विकास परियोजनाओं को प्रायोजित करने वाले विभिन्न सरकारी विभागों, संस्थानों और उद्यमों द्वारा दिए गए सहयोग के प्रति क्षे अ प्र कृतज्ञ हैं। उनके साथ निकट परस्पर संवाद से अर्थपूर्ण अनुसंधान एवं विकास सहयोग के नए युग का सूत्रपात हुआ।

अनुसंधान एवं विकासात्मक प्रयासों में दिये गये दिशा निर्देशों के लिए क्षे अ प्र विशेष रूप से डॉ. पी. रामा राव, चेयरमैन, अनुसंधान परिषद, डॉ. एस. के. जोशी, भूतपूर्व महानिदेशक, वै औ अ प, डॉ. आर. ए. मशेलकर, महानिदेशक, वै औ अ प और अनुसंधान परिषद के सदस्यों, प्रबंध परिषद की आभारी है। वै औ अ प से मिला नेतृत्व हमारे लिए अत्यंत महत्वपूर्ण है। प्रयोगशाला को बिल्डिंग मैटीरियल्स टैक्नोलॉजी प्रोमोशन काउंसिल से बहुमूल्य तकनीकी और वित्तीय सहायता मिली जिसके लिए डॉ. टी. एन. गुप्ता, कार्यकारी निदेशक को विशेष अनुग्रह।

डॉ. राम प्रसाद, महानिदेशक, एम पी सी ओ एस टी से मिले निर्देश एवं सहायता के कारण राज्य अनुसंधान एवं विकास मिशन, मध्य प्रदेश विज्ञान एवं प्रौद्योगिकी परिषद तथा अन्य संगठनों से निकट परस्पर संवाद संभव हो सका। मध्यप्रदेश राज्य सरकार के राजीव गांधी अनुसंधान एवं विकास मिशन निदेशालयों से प्राप्त अनुपम सहयोग और सहायता के लिए आभार।

क्षे अ प्र, भोपाल के सभी वैज्ञानिक एवं कर्मचारी प्रयोगशाला के विकास एवं प्रगति के लिए पूर्ण निष्ठा से कार्यरत रहे।

टी. सी. राव

(टी.सी. राव)
निदेशक

Executive Summary

Executive Summary

Significant Developments

S.No.	Brief description	Present status
1.	FRP Gear Case for Traction Motors	• Six cases fitted on Loco No. 166604 by Diesel Locomotive works were dismantled after over 15 months trials. They were refitted after minor repairs. Nothing adverse is reported.
2.	Wood Substitutes	• Two licenses were given for manufacture of R-wood products. BMTPC is advising on marketing strategies for these products.
3.	Prototype Housing Units	• 16 apartments are being built (supported by NBO) as demonstration units for CSIR technologies such as clay fly ash bricks, RMP doors, red mud cementitious binder and pre-cast roofing.
4.	Centre for Characterisation of Building Materials	• Centre is equipped with modern facilities worth over Rs.120.00 lakh with DST and BMTPC funding. • Centre has carried out specific characterisation and evaluation assignments. • Steps initiated for accreditation so that the Centre becomes a major National facility.
5.	MMCs, Squeeze Casting Preforms etc.	• Sections of 1.5mm extruded tubes with circular and rectangular cross sections and rolled sheets of 1.5mm thickness have been made under a project supported by ISRO.

Contd.

S.No.	Brief description	Present status
		• Work on squeeze cast automotive components like crown handle, upper and lower brackets for scooters being planned.
		• Brake drum for Maruti Van being fabricated by our collaborator M/s Rasmi Die Castings, Hyderabad. Trials of over 2500 hrs completed on brake drum for jonga jeep at VRDE.
6.	Mine Implements	• Field trials at Rajrappa Mines taken up. Quality assurance tests of the castings were carried out using radiographic, metallurgical, tribiological techniques.
		• Hard facing materials suitable for AFC pan have been selected and 3 pans were hard faced at Moonidih for field trials.
7.	Farm Implements	• Field trials related to wear studies of sweeps, cultivator shovels in black sandy clay loam, red sandy clay loam, and black clay (wetland) have been carried out.
8.	Coal and Minerals studies	• Science and Technology Advisory Committee (STAC) of DST has identified RRL, Bhopal as lead agency to take up joint research, development and demonstration project on vorsyl separator
9.	Resources Development	• Projects have been structured into three areas — Groundwater Resources Management — Contamination studies — Watershed Development
		• Prepared action plan solving drinking water problems in 31 villages of Dhar dist.
		• Prepared thematic maps for 63 milliwatersheds.
		• Preparing plan document for watershed through involvement of beneficiaries and implementing the plan on the field.
		• Completed a study predict the ground water quality scenarios around landfill at Siruseri in case of failure.

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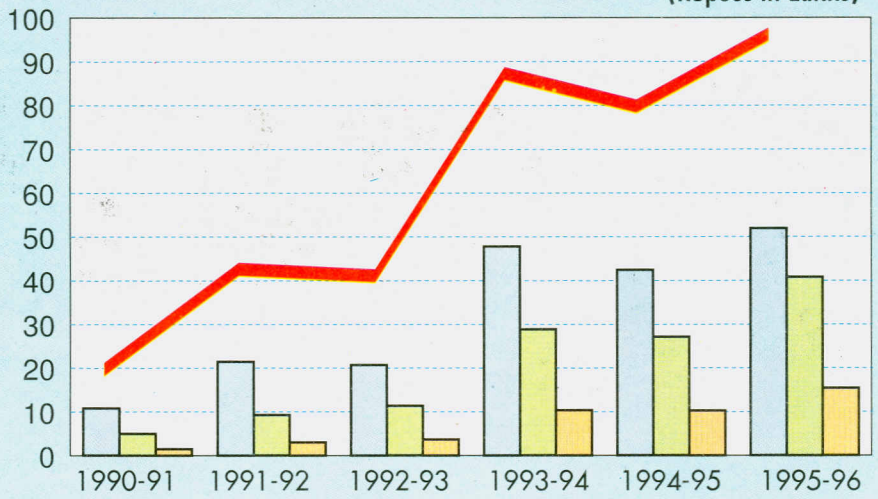
SOME MAJOR INDICATORS - ECF VS OTHERS

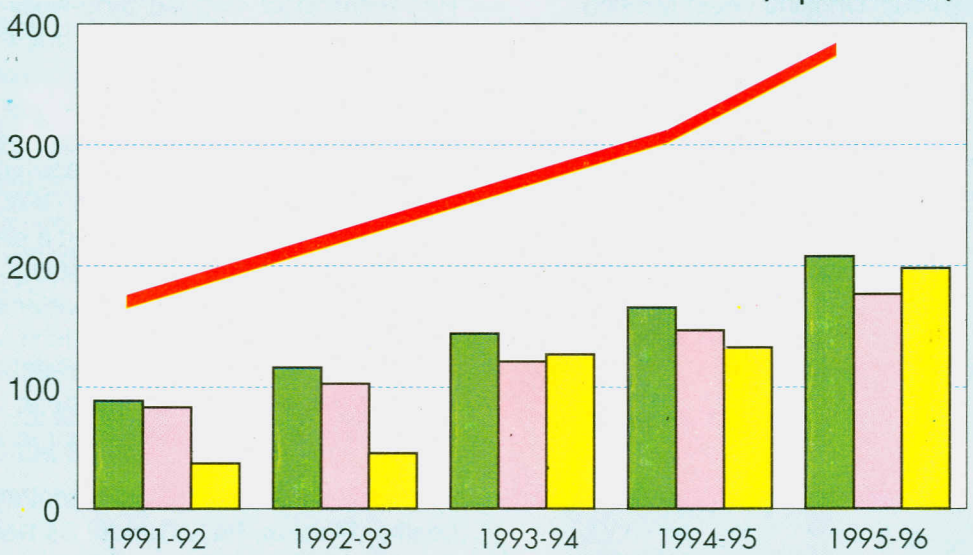
(Rupees in Lakhs)



ECF as % of Rec. Exp.	20.9	41.8	39.2	88	80	96
ECF as % of Tot. Bud.	10.8	21.5	20.7	47.8	42.4	51.9
ECF per 10 Scientists	5	9.3	11.4	28.8	27.1	40.8
ECF per 10 Persons	1.5	3	3.7	10.4	10.3	15.4

SOME MAJOR INDICATORS - BUDGET VS ECF

(Rupees in Lakhs)



Total Expenditure	172.657	219.248	265.69	313.096	384.695
Recurring Expenditure	88.947	116.348	144.334	165.962	207.945
Capital Expenditure	83.71	102.9	121.356	147.134	176.75
ECF Receipt	37.224	45.6	127.015	132.817	198.28

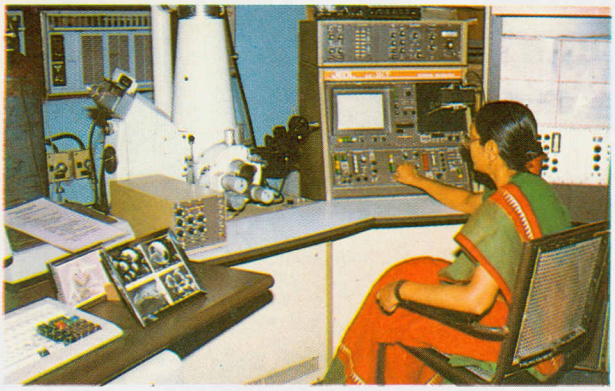
Training programme for women on sisal fibre handicrafts

S.No.	Brief description	Present status
10.	National Drinking Water Mission	• Rejuvenation of clogged tube-wells by non toxic chemical cleaning is carried out in many sites identified by PHED with encouraging results in terms of output from the tube-wells.
11.	Fly ash Utilisation for Wasteland Development	• Pilot project at NTPC, Rihandnagar, on 15 acres sites is completed satisfactorily. TIFAC mission on fly ash utilisation has sanctioned a project for long term evaluation of this work. NALCO, IFFCO have considered similar work to be undertaken
12.	Environmental Studies	• EIA studies, Risk assessment, Safety audit etc. for industries in the region has been undertaken through externally funded assignments. • Joint projects are being carried out with National Leather Mission, Rajiv Gandhi S&T Mission on Rural Industries for EIA studies on proposed leather complexes being set up around Bhopal.
13.	S&T for Tribal Women	• Training of trainers amongst tribal women in preparation of herbal formulations, handicrafts based on sisal fibres.

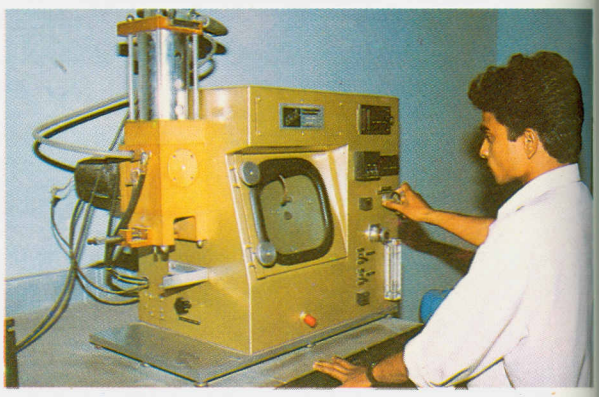
Agreements for Collaborative Work / Tech. Transfer

S.No.	Name of party	Date of agreement	Nature
1.	M/s Rasmi Die Castings Ltd., Secunderabad.	13.10.93	Collaborative arrangements for Component Development on Al-alloy based particulate composites.
2.	M/s Atlas Automotive Components Ltd., Pune.	09.11.93	Collaborative arrangements for development of a process for manufacture of Al-alloy casting by squeeze casting incorporating ceramic fibre preforms and salt cores for making AMMC castings.
3.	M/s Rasmi Die Castings Ltd., Secunderabad.	13.01.94	Component development based on SLIZ alloys.
4.	M/s Environmental Technologies India Ltd., Nagpur.	25.10.94	Clay fly ash bricks.
5.	M/s Bharat Zinc Ltd., Bhopal.	30.11.94	Lab-scale process for reduction of magnesite into leachable manganese oxide.
6.	M/s Orient Cerwool Ltd., Lakhtar	03.12.94	Royalty terms for ceramic fibre preforms.
7.	M/s Elcaps Ltd., Mandideep.	25.01.95	Technology transfer on low voltage electrolyte.
8.	M/s Permali Wallace Ltd., Bhopal.	07.02.95	Technology transfer on FRP gear case.
9.	M/s Bharat Zinc Ltd., Bhopal	24.03.95	Collaborative project on leachable manganese oxide for pyrolusite.
10.	M/s Optel Telecommunications Ltd., Bhopal.	14.08.95	Effluent treatment plant design.
11.	M/s Environment Technologies (India) Ltd.(ETIL), Nagpur.	08.09.95	EIA hazardous waste dumping site at Jabalpur.
12.	M/s M.P. State Industries Corpn., Bhopal.	28.09.95	R-wood manufacture.
13.	M/s Dual & Visual Group of Company, Madras.	10.10.95	R- wood manufacture.
14.	M/s National Fertiliser Ltd., Vijaipur.	06.11.95	Groundwater quality assessment.
15.	Rajiv Gandhi Gramodyog Missions, Bhopal.	19.02.96	EIA studies for Bhopal Leather Complex.

Major Facilities



Scanning electron microscope



Gas jet erosion tester

X-ray diffraction unit

Universal testing machine

Chemical analysis laboratory

RRL has modern equipment and instrumentation for chemical analysis, minerals processing, mechanical testing and metallography in addition to well-equipped foundry, workshop and Library. The equipment include: Scanning Electron Microscope, X- ray Diffractometer with PC-APD software, TAS Plus Image Analyzer, Atomic Absorption Spectrometer, DCP Spectraspan, Simultaneous Thermal Analyzer, Particle Size Analyzer, INSTRON Universal Testing Machine, Stress Rupture Testing Machine, Friction and Wear Testing Machine, Rubber Wheel Abrasion Tester, Gas Jet Erosion Tester, Bearing Test Rig, Talysurf Apparatus, Fatigue Testing Machine, Pressure Die-casting Machine, Melt Spinner, 150 T Hydraulic Press, High Temperature Furnace, Plasma Spray Unit, Computerised Hysterisisgraph, Mozely Hydrocyclone, Wet High Intensity Magnetic Separator, Mozely Mineral Separator, Mozely Vanner, Mozely Multi-Gravity Separator, Wilfley Table, Water-only Cyclone, Heavy Media

Cyclone, Vorsyl Separator, Flotation Cells and Columns, Air-sparged Hydrocyclone, computer facilities.

A centre for characterisation of Building Materials is being set up at RRL Bhopal with support from the Building Materials Technology Promotion Council (BMTPC) of Min. of Urban Development, Department of Science and Technology and CSIR.

SERVICES OFFERED

Consultancy services and technical services comprising testing and analysis, training, assistance of advisory nature, etc. are extended. Major areas are specialised materials testing, engineering failure analysis, building materials characterisation, minerals processing, environmental impact assessment, environmental auditing, safety auditing, hydrogeological investigation, effluent treatment plant design, and user specific software development.

Our clientele includes MPEB, NFL, TISCO, BHEL, EPCO, NMDC, UNICEF, OTL, Lupin Labs and many industries in the region.

Linkages

Central Govt. Deptts., Agencies, Institutions

Department of Mines, Indian Bureau of Mines, Department of Science and Technology, Department of Atomic Energy, Ministry of Urban Development, Housing and Urban Development Corporation, Indian Space Research Organisation, Defence Metallurgical Research Laboratory, Indian Council of Agricultural Research, Central Institute of Agricultural Engineering, Central Ground Water Board, National Bank for Agricultural and Rural Development, Indian Institute of Science, Indian School of Mines, Building Materials and Technology Promotion Council, Central Public Works Department, National Building Organisation, UNICEF.

Madhya Pradesh State

Madhya Pradesh Council of Science and Technology, Madhya Pradesh State Mining Corporation, Water Resources Department, Public Health Engineering Department, District Administration in Tribal Regions, Rajiv Gandhi S&T Mission Directorates, Environmental Planning and Coordination Organisation, Tawa Ayacut Development Authority, Madhya Pradesh Electricity Board.

Industrial Sector including PSE's, private and local industry

Bharat Heavy Electricals Limited, Bhopal; National Aluminium Company, Bhubaneswar; Central M Planning and Design Institute Limited, Ranchi; National Thermal Power Corporation, Rihandnagar a Ramgundam; National Fertilizers Ltd., Guna; National Mineral Development Corporation, Hyderab Hindustan Zinc Limited, Udaipur; TISCO, Jamshedpur; M/s Orient Cerwool Limited, Lakhtar; M/s Perm Wallace Limited, Bhopal; M/s Diamond Cements Ltd. Damoh; M/s Rasmi Die Casting Ltd. Hyderab M/s Atlas Automotive Components Ltd. Pune; M/s Bharat Zinc Limited, Bhopal; M/s Elcaps Ltd. Bhop M/s Optel Telecommunications Limited, Bhopal; M/s Environmental Technologies (India) Ltd. Nagpu

CSIR Institutions

National Environmental Engineering Research Institute, Nagpur; Indian Institute of Chemical Techn ogy, Hyderabad; Central Leather Institute, Madras; Central Building Research Institute, Roorkee.

Projects in Building Materials

S. No.	Technology/Project	Agency	Project cost (Rs.in lakh)	Status
1.	Building materials characterisation and testing centre	BMTPC	67.00	completed
2.	Pilot project for wasteland development	NTPC	12.00	ongoing
3.	Construction of 16 proto-type house using innovative construction techniques and materials by RRL	NBO	15.00	ongoing
4.	Development of photoclear flexi glass moulding	BHEL	3.75	ongoing
5.	A study on mechanical properties of sisal fiber produced in M.P.	MPCOST	0.52	ongoing
6.	Integrated approach for design and development of fiber reinforced plastics building components	BMTPC	15.00	ongoing
7.	Development of red mud fiber reinforced polymer composites for building components as wood substitute	NALCO	2.90	ongoing

Projects in Metallurgy and Materials

S. No.	Technology/Project	Agency	Project cost (Rs.in lakh)	Status
1.	Development of aluminium metal matrix composites for aerospace applications	ISRO	10.48	ongoing
2.	Process development for manufacture of bonded magnets of rapidly solidified Nd-Fe-B alloys	MPCOST	0.59	ongoing
3.	Survey of medical X-ray equipment	AERB	8.00	ongoing
4.	Life extension of coal feed bunkers at STPS, Sarni	MPEB	4.96	completed
5.	Failure investigation of coal feed bunker at STPS, Sarni	MPEB	3.60	ongoing
6.	Development of suitable grinding media	MPCOST	0.60	Ongoing

Contd.

S. No.	Technology/Project	Agency	Project cost (Rs.in lakh)	Status
7.	Metallurgy and process development for quality upgradation for better performance of critical parts of agricultural machinery	ICAR	9.19	ongoing
8.	Process development on a semicommercial level for ceramic preforms	OCL	0.30	ongoing
9.	To investigate the possibility of indigenisation of retaining rings for the use in high voltage high speed squirrel cage	BHEL	2.85	ongoing
10.	Effect of rate of deformation on magnetic anisotropy of Nd- Fe-B alloy	Indo-US	14.88	ongoing
11.	Analysis of interlayer bonding for making sound trimetallic thrust bearing for hydrogenerators	BHEL	3.95	ongoing
12.	Development of a process for making leachable MnO from pyrolusite	BZL	1.20	ongoing
13.	Improvement in the Rejuvenation for clogged tube-wells by employing non-toxic chemical cleaning	RGNDWM	9.59	ongoing
14.	Improving life of mine implements through tribological studies	CMPDIL	36.79	ongoing
15.	Characterisation of fly ash from ten thermal power stations	CBIP	11.40	ongoing

Projects in Minerals

S. No.	Technology/Project	Agency	Project cost (Rs. in lakh)	Status
1.	Modelling and scale up studies in water only cyclone treating coal	CMPDIL	3.00	ongoing
2.	Industrial applications of Vorsyl separator in CCL coal washery	DST	5.00	ongoing
3.	Installation of plant scale water only cyclone at Jamadoba washery	TISCO	3.00	ongoing
4.	Installation of 24" Vorsyl separator at West Bokaro washery- II	TISCO	2.50	ongoing
5.	Industrial applications of Vorsyl separator in BCCL coal washery	CMPDIL	4.20	ongoing
6.	Performance evaluation of airsparged hydrocyclone to treat Indian coal fines	CMPDIL	9.92	ongoing
7.	Studies on entertainment in froth flotation of fine coal	NSF	4.20	ongoing
8.	Design and upgradation of effluent treatment plant for Optel Telecommunications Ltd., Mandideep	OPTEL	1.25	ongoing
9.	EIA and landfill design for hazardous waste disposal site at Jabalpur	ENV	1.50	ongoing
10.	Comprehensive environmental impact assessment for proposed leather complex at Adampur	LTM	11.00	ongoing
11.	Rapid and comprehensive EIA studies for proposed 25 MW captive power plant at Indore	EIA	8.00	ongoing
12.	To standardise the specifications of sodium oleate used in phosphate beneficiation	RSML	0.500	ongoing
13.	Studies on separation characteristics of Dynawhirlpool separator treating coal	DST	7.61	ongoing

Projects in Resources Development

S. No.	Technology/Project	Agency	Project cost (Rs.in lakh)	Status
1.	Groundwater evaluation through modelling in the area of Tawa river basin	DST	8.97	completed
2.	Development of true groundwater surface with the help of mathematical modelling	DST	1.34	completed
3.	Micro-level study on water-logging problem at Kharar village Seoni-malwa block, Hoshangabad dist., M.P.	TADA	5.45	ongoing
4.	Environmental impact assessment for Reliance Petroleum Ltd., Jamnagar	NEERI	2.50	completed
5.	Comprehensive environmental impact assessment of proposed hazardous waste disposal site at Menallure, Tamil Nadu	NEERI	1.50	completed
6.	Artificial recharge studies in Dhar district	UNICEF	11.22	ongoing
7.	Preparation of thematic maps of selected DPAP/EAS districts of M.P.	RGMWD	30.00	ongoing
8.	Groundwater balance studies in dark areas with special reference to Sanwer block, Indore, M.P.	NABARD	5.21	ongoing
9.	Detection in miniaturized separation systems	EC	40.00	ongoing
10.	Development of monitoring mechanism for the planning and implementation phase of watershed development	RGMWD	4.75	ongoing
11.	Study to predict impact on groundwater quality due to the long term application of treated effluent on land at NFL, Vijaipur	NFL	7.23	ongoing
12.	Groundwater quality studies for comprehensive EIA of proposed hazardous waste disposal site at Sirsuri, Tamilnadu	NEERI	1.00	completed
13.	Preparation of plan document and implementation in Begumganj watershed, Raisen district, M.P	DRDA	43.00	ongoing

Project Details

Clay fly ash bricks

RRL, Bhopal has developed high strength, superior quality bricks using fly ash as one of the constituent. Fly ash is added with inferior soil (black cotton) in certain percentage giving higher comprehensive strength. Bricks thus obtained have good quality, uniform shape, good strength and less water absorption properties as per IS standards.

The striking advantage of fly ash bricks is its superior quality and strength in the range of 4 to 8 MPa where as conventional has the max. of 4 MPa.

Sixteen apartments being built with NBO assistance using CSIR technologies

Red mud cementitious binder

About 2.0 million tonnes of red mud is being generated as a waste material from aluminium plants the present process red mud is used for production of cementitious binder suitable for construction w It has been found that this binder can be used for foundation, base concrete, masonry work etc.

The binder technology developed by using red mud and rice husk with clay is giving good results wh are equivalent to pozzolanic cement.

Red mud polymer composite shutters

Wood has been the traditional and most extensively used building material in several components doors, windows, partition walls etc. With the increasing environmental hazards due to cutting of wo in forests, the use of wood is being restricted in India. In addition to that there is a large quantity industrial waste such as red mud and fly ash are generating environmental pollution. Keeping in vi RRL, Bhopal has developed a new wood substitute using such industrial wastes and natural orga fibres.

The product has excellent engineering properties and has been approved by the Central Public Wo Department.

Wasteland development

Pilot scale studies were carried out to see the impact on soil admixed with fly ash different proport and interval. These were done by evaluating the properties such as soil texture, density, porosity, wa retention capacity, pH and ion exchange capacity. It reveals from the results that fly ash application wasteland development depends mostly upon the method of application in relation to morphologi and mineralogical properties of soil and fly ash, reactivity of ash, climatic condition, moisture conten the soil under operation soil pH, ion exchange capacity finally the percentage addition of ash.

A view of experimental site at Nilgiri, NTPC, Rihand

It is proposed to study on long range effect of fly ash use in agricultural purpose will further be extended for another three years to assess the qualitative improvement of wasteland soil treated with fly ash and its long range effect on vegetation and food quality.

Tillage of paddy of fly ash field

Aluminium metal matrix composites

SiCw reinforced 2014 age hardenable aluminium alloy matrix composites for aerospace applications have been developed at RRL, Bhopal. Sections of 1.5mm extruded tubes with circular and rectangular cross sections and rolled sheets of 1.5mm thickness have been made under a project supported by ISRO. The reinforcement is in the form of pre-forms of whiskers and short fibers. Similarly work on squeeze cast components for automotive applications like crown handle, upper and lower brackets for scooters is in progress. All these projects involve partners from industry at various stages of development such as fabrication of pre-forms, squeeze casting and infiltration process, and evaluation of materials and components.

Recently RRL, Bhopal has developed a process for making particle reinforced aluminium alloy composites using solidification processing technique. Aluminium alloy hard particle composites have been prepared for making brake drums for Nissan Jonga Jeep. The composite brake drums have been tested in a Nissan Jonga Jeep at VRDE, Ahmednagar. Initial results are quite encouraging wherein they have exhibited improved braking efficiency and reduced frictional heating over conventional cast iron components under identical test conditions.

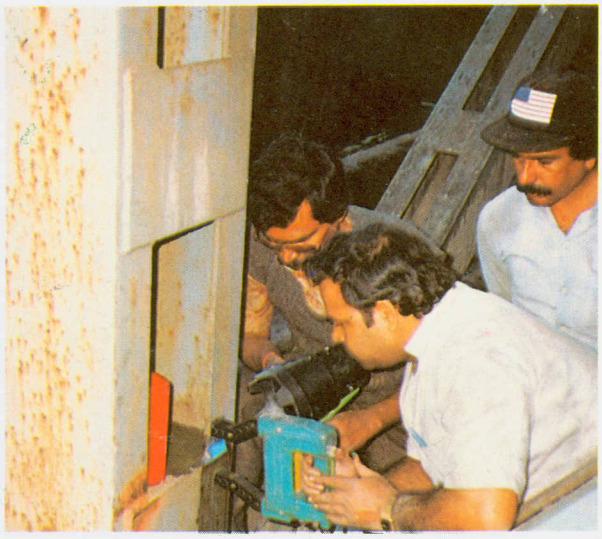
Maruti Udyog Limited has shown interest for using Al alloy composites for making brake drums. M/s Bajaj Auto Limited, Pune has also shown interest to develop cylinder block using Al composites.

Nd-Fe-B Magnets

Indo-US collaborative project with Naval Research Laboratory, Washington, DC, USA has been started. The objective of the project is to establish deformation map for a specific composites of Nd-Fe-B alloy and to understand effect of strain rate and temperature on magnetic anisotropy. Work on alloy preparation, melt spinning, selection of deformation processing parameters has been undertaken.

Failure analysis of components

RRL has developed a sustainable expertise and facilities in the area of failure analysis of power plant components, life extension studies and assessment of coal feed bunkers. As a result the services of the laboratory were called upon from MPEB for condition evaluation of ESPs, coal feed bunkers, life improvement of structures of coal handling plants, and stability evaluation of various structures.



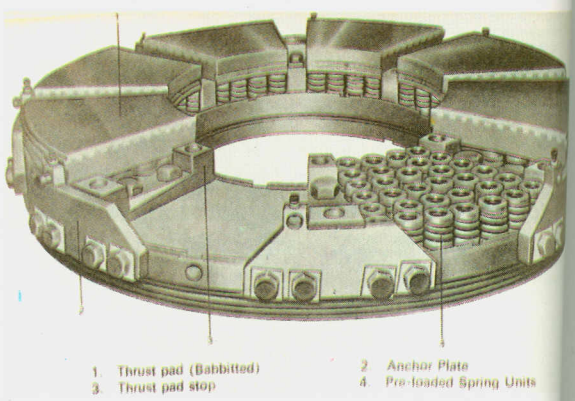
Non-destructive examination to evaluate remnant life of ESP structure

Non-destructive examination of floor of water treatm plant to assess the extent of degradation

Metallurgical investigations for remnant life assessment of ammonia plant inlet nozzle and boiler were undertaken for NFL, Vijaipur and Diamond Cement, Damoh.

Trimetallic thrust bearings for hydrogenerators

RRL initiated a project sponsored by BHEL to prepare trimetallic thrust bearing by inserting a conducting layer of copper in between the babbitt lining and the steel backing. The development of trimetallic bearing is expected increase working efficiency of hydrogenerators in terms of increased thrust load and speed compared to conventionally used bimetallic bearings.



Thrust bearings for hydrogenerators

Chemical hydrofracturing of clogged tube-wells

Encrustation is commonly observed in a large number of tube-wells leading to reduced water output, and in extreme cases, complete failure. It is the deposition of organic or ino materials within the gravel shroud around screen or upon the surfaces of the screen, the casing pump and discharge assembly.

Under the National Drinking Water Mission, a project on Rejuvenation of clogged tube-wells was by RRL.

Water samples from the tube-wells/hand pumps in villages near Bhopal, identified in collaborati PHED Engineers were collected.

The residual solid material after complete evaporation of water was used for different laboratory

Dismantling hand pipe line alongwith cylinder for chemical hydrofracturing

Packing on hand pump prior to hydrofracturing

Final washing

Based on the results obtained from the mineralogical and chemical analysis of clogging materials, chemical compositions were prepared. The cleaning formulation included a non-toxic inhibitor and loosening and suspending agent.

A substantial increase in water yield after non-toxic chemical cleaning process of chemical hydro turing for cleaning of clogged tube-wells was recorded.

Tribological studies on mine implements

Pattern for the tooth points was modified to the required dimensions after a number of trial and e One set of six tooth points was tested each at SECL, Gevra and CCL, Rajrappa mines. The tooth p showed a working life of ~375 hrs. at SECL, Gevra. The performance of the tooth points at Raj varied over a wide range. Attempts are being made to prepare tooth points of improved varieti further testing work.

Ten number of hard faced pans were sent to the underground mines at Munidih for field trial. The are to be dismantled for inspection after a year of trials.

Development of farm implements

A variety of agricultural implements were subjected to different heat treatment cycles and/or su modification. The treated implements were given to several farmers to assess their performance u actual working conditions. The tests are in progress and preliminary observations have been en aging.

Modified farm implements were distributed to farmers for field trials

Heat treatment of duckfoot sweeps of 14 inch and 12 inch sizes was done at laboratory and supplied to CIAE, Bhopal for the field trials. These sweeps were distributed amongst the farmers through the Director, CIAE for performance monitoring.

Spikes are critical parts used in threshing machines. The spikes of various heat treated rnaterials have been supplied to CIAE, Bhopal for field testing.

Surface Engineering Centre

The Nation wide TIFAC sponsored exercise on the existing technology, gaps and market potential surveys in surface engineering has now been accomplished with the receipt of all relevant material from the participating agencies. RRL is one of the five nodal centres involved in this activity.

The findings of the surveys are completed in the form of two comprehensive reports, devoted to literature survey and business opportunities respectively. In addition a comprehensive bibliography on the relevant surface engineering technique covered in the surveys has been prepared.

Fundamental studies on stress corrosion of metals

Under a project supported by DAE, studies were carried out on stress strain behaviour and fracture characteristics of metals namely aluminium, mild steel and stainless steel have been carried out to study the effect of applied potentials and galvanic coupling on unstressed and stressed samples. A correlation on effect of stress on the chemical potential of matrix atoms of metals responsible for failure of metals under synergistic effect of tensile stress and environment leading stress corrosion is being attempted.

The review of recent literature indicates that understanding of the stress corrosion behaviour of sta steel in the presence of dissolved carbon dioxide is very important as it is encountered in nuclear e installation as well as in the crude oil production from oil wells.

Characterisation of fly ash from ten thermal power stations

There is an increasing demand for applications of fly ash generated from thermal power statio agriculture and value added materials in bulk quantity. Fly ash contains alumino- silicate alongwith metallic and non-metallic ions partly in the amorphous state and in the form of microsp ceno-spheres with a large surface area and the ash is abundantly available.

Bottom ash and pond ash of both the thermal power stations UPSEB, Anpara and Vijayawada th power station (VTPS) contain micro-nutrients (Zn, Cu, Fu & Mn) and macro-nutrients (N, P, K & S more useful for agriculture purposes and wasteland development compared to the ash samples ESPs.

Ash mixed with 5 wt.% rock phosphate and also bio-materials like Algae have shown better resu improved growth rate of plants and vegetables yield because of higher intake of useful ions.

Samples from Electrostatic Precipitator (ESP) and ash collected in dry condition have shown pro capability as anticorrosive and abrasion resistant coating material on steel surfaces.

Training on bell metal handicrafts

The programme was organised by CSIR Polytechnology Transfer Centre, Patna and RRL, Bhopa training programme was conducted at the Pareo village which is about 38 Km. away from Patna March 11-21, 1996. Fortynine artisans consisting fortyone males and eight females had participa

Training on bell metal handicrafts was held at Pareo village, near Patna

the programme. It was learnt that about five hundred families are engaged in making bell metal, bronze and German silver utensils and other kitchenware items. During the programme a new technology was demonstrated for making various types of small, big and intricate handicraft decorative items of bell metal (90% copper, 10% tin) and brass (68% copper, 30% zinc and 2% tin).

Exploratory investigations of fly ash as raw material for industrial ceramics

There is an increasing demand for applications of mullite, SiAlON, Si_3N_4, composites of Al_2O_3 + SiC + SiAlON whiskers, AlN and SiC as structural engineering and wear parts material. A laboratory process was developed to produce these in particulate and whiskers form (50-100 microns) and the products were characterised.

Fly ash collected from the electrostatic precipitators has larger quantities of tiny hollow spheres (cenospheres) which can be easily converted to SiAlON whiskers by the simultaneous carbo-thermal reduction and nitridation.

Wet high intensity magnetic separator (WHIMS) and Multigravity separator (MGS) further help to get enriched alumino-silicate fraction of glassy spheres.

The ceramic powders were sintered by reaction sintering at RRL, Bhopal and M/s WIDIA Indian Ltd., Bangalore. The sintered product has less porosity, density 3.1-3.20 gm/cm^3, micro hardness upto 2000 VHN and show that the materials bear good potential for viable applications in wear parts.

Industrial applications of Vorsyl separator in BCCL coal washery

Coking coal of - 25 + 0.5 mm size is mainly treated in dense medium cyclones which accounts for more than 50% of total clean coal produced in the country. Extensive laboratory tests carried out at RRL, Bhopal have shown that Vorsyl separator, an alternate dense medium separator, performs better than the conventional cyclone. A typical comparison of the values of yield obtained from dense medium cyclone and Vorsyl separator at the ash content around 18% is given below.

	DM cyclone (%)	Vorsyl separator (%)
Clean coal yield	70.08	75.06
Clean coal ash	17.88	17.86
Feed ash	30.21	30.21

The 5% increase in yield in the case of Vorsyl separator is due to the better separation of near gravity material and less misplacements in product streams.

Installation of Vorsyl separator in the existing washery does not need major changes in the circuit.

RRL, Bhopal has launched studies to compare performances of Vorsyl separator and dense medium cyclone in three different washeries with financial support from Tata Iron and Steel Company Ltd., Department of Coal and Science and Technology Advisory Committee of Department of Science & Technology, Government of India. Plant trials will be carried out in West Bokaro Washery II (600 mm unit), Dugda Washery II (500 mm unit) and Swang Washery (600 mm unit).

It is expected that the results obtained from the on-going projects on industrial application of Vorsyl separator will bring a logical conclusion regarding the selection of appropriate dense medium separator vis-a-vis feed coal characteristics.

Studies on separation characteristics of Dynawhirlpool separator

This project has been sponsored by Department of Science and Technology to evaluate the performa of Dynawhirlpool separator, a novel centrifugal dense medium separator. Experiments are planned us Indian coking coals for studying the effect of important process and design variables on the performa of Dynawhirlpool separator. Quantitative studies have been proposed on performance evaluation mathematical models. A 76 mm diameter Dynawhirlpool separator with appropriate test rig was desig and fabrication of the equipment is going on.

Performance evaluation of air-sparged hydrocyclone to treat India coal fines

The Run-of-Mine Coal would consist of about 20 percent fines. To satisfy the demand of coking coa our iron and steel industry, these coal fines have to be utilised. Froth flotation process is generally us to clean coal fines. But both mechanical and column flotation cells have less capacity. Therefore, to m the demand of our coking coal it is necessary to look for an alternate equipment. In this resp Air-sparged hydrocyclone (ASH) is a promising one, which has been designed by Prof. Mille University of Utah and successfully tested using coal fines. However, no experimental results have b reported on the performance of ASH using Indian coals. In the present study an attempt will be m to evaluate the performance of ASH with Indian coal fines.

Study on micro-level water-logging remedial solutions around Kharar village of Hoshangabad dist. M.P.

Based on the field investigations, an experiment has been initiated to grow selected varieties non-conventional crops such as aromatic plants with the help of Central Institute of Medical and Arom Plants, Lucknow. An area of one hectare from severe water-logged areas has been selected experimentation. Lemon grass were planted and their growth rate under water logging condition being studied. Economics of aromatic plantation in water-logged areas shall be studied.

Artificial recharge studies in parts of Dhar Dist. M.P.

The project has been carried in association with District Administration and Public Health Enginee Department (PHED), Govt. of M.P. The study is aimed at suggesting suitable schemes to mitigate drinking water problems. Field investigations were carried out to delineate the geology, hydrogeo etc. Satellite imageries were also used to interpret the geology, geomorphology, land use/land c mapping. Both satellite imageries and field data were integrated to prepare village level action plan water conservation and augmentation of groundwater recharge. These plans are being implemente PHED, Govt. of M.P. to mitigate the drinking water problems.

Groundwater balance studies in dark areas with special reference Sanwer block, Indore Dist.

A mathematical model based on the equivalent porous media approach has been formulated a being calibrated. Field investigations were carried to understand geology, hydrogeology, hydromet ogy of the area with special reference to groundwater balance studies. Aquifer performance tests carried out to understand the aquifer characteristics of the study area.

Studies to predict impact on groundwater quality due to long-term application of treated effluent on land at NFL, Vijaipur, M.P.

The objective of the study is to assess the impact on groundwater quality due to the long-term application of treated effluent on the ground. Field surveys were carried out to understand geology and hydrogeology. Water levels in dugwells and hand pumps were collected. Water samples for these observation points and treated effluent were analysed for the quality constituents. Also the samples are analysed for isotopic composition to establish between effluent and groundwater sample.

Watershed management

Rajiv Gandhi Mission for Watershed Development has identified RRL as a Resource Institution for providing R&D support. Under the programme, milliwatersheds having an area of approximately 100km^2, in 13 districts, have been delineated and are coded based on National Watershed Atlas coding.

Thematic maps on drainage, slope, hydrogeomorphology and land use/land cover were prepared for 64 watersheds spread over 9 districts. For the thematic map preparation False Colour Composite (FCC) imageries of IRS1B satellite and toposheets are used as data sources. These thematic maps are verified from limited field surveys.

Having provided inputs in the above aspects RRL has been appointed as Project Implementing Agency by RGMWD for developing Begamganj Watershed, Raisen district, M.P. The objective of the programme is to prepare a blueprint for watershed development through scientific inputs and people's participation in development and implement watersheds. RRL on one hand is preparing technological plans for

Scientists explaining the work in implementation of watershed management in Begumganj, district Raisen under the Rajiv Gandhi Mission for Watershed Development

watershed development to meet the requirements of villages and on the other educating the people o the watershed activities.

Having prepared the blueprint, the planned activities such as contour, bunding, trenches, teracing, gu plugs etc. are being undertaken to conserve water and augment recharge.

Groundwater quality studies for comprehensive EIA of proposed hazardous waste disposal site at Sirsuri, Tamilnadu

The objective of the study is to estimate groundwater potential of the region, assess groundwater quali predict its variation in case of contamination by any one of the chemicals from the land fill site and suggest technological options to monitor the contamination and prevent pollution. A mathematic modelling study to predict the likely scenarios of contaminant transport in aquifer is carried out.

Detection in miniaturized separation systems

A method has been developed for the determination of chlorophenols by the coupling a capilla electrophoresis system with an electrochemical detector. For the decoupling of the high voltage palladium union was used. Separation of (18 of the 19) chlorophenols was accomplished in a micel system using SDS.

The method has been applied for the analysis of (spiked) surface water samples. Chlorophenols we preconcentrated on a solid-phase extraction column and, after desorption and evaporation of the solve reconstituted in the electrophoresis buffer. The performance of the method is compared to that of HPL methods.

APPENDIX-1

RESEARCH COUNCIL

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Director,
Regional Research Laboratory,
Hoshangabad Road,
Bhopal-462 026.

Dr. D.N. Misra — **DG's Nominee**
Emeritus Professor,
Central Institute of Fisheries Education,
7 Bunglaws, Varsova,
Bombay-400 061.

Dr. R.N. Yadava — **Secretary**
Scientist EII,
Regional Research Laboratory,
Hoshangabad Road,
Bhopal-462 026.

The Research Council has been reconstituted for a period of three years with effect from 1.7.1994.

During 1995-96 Twelfth and Thirteenth Meetings of the RC were held on May 20,1995 and September 28,1995 respectively.

APPENDIX-2

MANAGEMENT COUNCIL

Prof. T.C. Rao Director, Regional Research Laboratory, Bhopal-462 026.	**Chairman**
Dr. A.D. Bhide Scientist, National Environmental Engg. Research Inst. Nehru Marg, Nagpur-440 020.	**Member**
Dr. A.K. Dubey Scientist CMRI Regional Centre CBRI Roorkee - 247 667	**Member**
Shri S.K. Bose Scientist, Regional Research Laboratory, Bhopal-462 026.	**Member**
Shri P.D. Ekbote Scientist, Regional Research Laboratory, Bhopal-462 026.	**Member**
Dr. (Ms.) Mohini Saxena Scientist, Regional Research Laboratory, Bhopal-462 026.	**Member**
Shri J. Prabakar Scientist, Regional Research Laboratory, Bhopal-462 026.	**Member**
Sr. Finance & Accounts Officer Regional Research Laboratory, Bhopal-462 026.	**Member**
DGSIR or his Nominee CSIR Headquarters New Delhi-110 001.	**Permanent Invitee**
Sr. Controller of Administration Regional Research Laboratory, Bhopal-462 026.	**Member Secretary**

During 1995-96 Nineteenth and Twentieth meetings of the MC were held on July 25, 1995 and December 21, 1995 respectively.

DISTINGUISHED VISITORS

Dr. Bhagirath Prasad, Commissioner, Bhopal Division and Chairman Tawa Ayacut Development Auth ity, Bhopal, April 5, 1995.

Dr. S.M. Prasad, Business Manager, International Stockhausen Inc., USA, April 5-6, 1995.

Shri S.M. Diddee, Director, CMPDIL, Ranchi, April 20, 1995.

Dr. Ashok Kumar, Dean, Institute of Technology, BHU, Varanasi, April 24, 1995.

Dr. O.P. Ratra, BMTPC, New Delhi, May 5, 1995.

Dr. G.P. Phondke, Director, PID, New Delhi, May 15-17, 1995.

Dr. S.K. Chopra, Former Director General, National Council of Cement & Building Material, May 1995.

Dr. Dinesh Mohan, Former Director, CBRI, Roorkee, May 20, 1995.

Dr. B.K. Sarkar, Director, CGCRI, Calcutta, May 20, 1995.

Shri Brijesh Jouhari, General Manager, Gwalior Potteries, June 21, 1995.

Shri H. Misra, IAS, Principal Secretary to Govt. of M.P. and M.D., M.P. State Industries Corporati Bhopal, June 23, 1995.

Dr. G. Thyagarajan, Former Director, Central Leather Research Institute, Madras, June 26-27, 199

Dr. Gary E. Staats, Resident Advisor, Deptt. of Energy, USAID, India, July 13-15, 1995.

Shri N.M. Shukla, Executive Director, Bhaskar Industries Ltd., Bhopal, July 14, 1995.

Shri Pratap Singh Baghel, Minister for Panchayat & Rural Development, M.P. State Govt., July 14, 19

Prof. T.S. Murty, Ex-DG, MAPCOST, July 20, 1995.

Shri Sunjoy Joshi, Director, Rajiv Gandhi Mission, July 25, 1995.

Shri S. Vijay Anand, Ferro Magnets and Allied Products, Hosur, August 28, 1995.

Shri S.D. Sharma, Chairman, Sadhana Phosphates & Chemicals Pvt. Ltd., New Delhi, August 30, 1995.

Shri S. Mitra, Optel Telecom, Ltd., Bhopal, September 8, 1995.

Dr. G.S. Siddhu, Ex. DGSIR, New Delhi, September 26, 1995.

Shri Uday Kumar Verma, Commissioner, Women & Child Welfare, Bhopal, September 28, 1995.

Dr. V.S. Ramamurthy, Secretary, DST, New Delhi, October 3, 1995.

Dr. A.D. Damodaran, Director, RRL, Thiruvananthapuram, October 9, 1995.

Dr. G.S. Siddhu, Former DGSIR delivers CSIR Foundation Day address

Shri A. Anjaiah, Director, Dual Fab Tech. Pvt. Ltd., Madras, October 10, 1995.

Dr. R.G. Kumble, Ex-Director, Dept. of Science & Technology, New Delhi, October 17-19, 1995.

Shri U.S. Tilve, Sr. Manager, Planning and Shri R.A. Kamat, Manager, Process Control, Sesa Goa Ltd., Goa, October 26-28, 1995.

Mrs. Nirmala Buch, Member, Public Enterprises Selection Board, New Delhi, November 2, 1995.

Dr. P.K. Jain, Dean, Gandhi Medical College, Bhopal on November 13, 1995.

Dr. S.C. Tiwari, Superintendent, Hamidia Hospital, Bhopal, November 13, 1995.

Shri V.D. Potnis, Chief Technical Supervisor, Office of State Vigilance, General Administration, Bhopal, November 17, 1995.

Shri B.K. Malik, GM, Orient Cerwool Limited, Lakhtar, November 25-28, 1995.

Shri N.M. Shah, Orient Cerwool Limited, Lakhtar, November 25-28, 1995.

Shri R.K. Dutta, Eternit Everest Ltd., Kymore, Jabalpur, December 10, 1995.

Shri Thomas J. Cova, Researcher, National Center for Geographic Information and Analysis (NCGIA), Department of Geology, University of California Santa Barbara, USA, December 12, 1995.

Dr. V. Parthasarathy, Project Engineer, Carpco Inc., USA, December 14, 1995.

A delegation from Confederation of Indian Industry (CII), Western Region - Madhya Pradesh, Bhopal Zonal Committee, December 15, 1995.

Dr. S.K. Kawatra, Professor, Department of Metallurgical & Materials Engineering, Michigan Technological University, Houghton, USA, December 28-30, 1995.

Dr. B.U. Nayak, Director, Central Water and Power Research Station, Pune, January 3, 1996.

Dr. M. Sengupta, Director, Ministry of Environment and Forests, New Delhi, January 8, 1996.

Prof. L.A. Utracki, National Research Council, Canada, January 23, 1996.

Prof. D.D. Kale, UDCT, Bombay, January 23-24, 1996.

Dr. Vibhuti N. Misra, Director & Professor, Department of Minerals and Energy, Mineral Processing Laboratory, Western Australia School of Mine, Australia, January 24-26, 1996.

Shri Soumitra Biswas, Director of Technology Information, Forecasting and Assessment Division, Deptt. of Science & Technology, February 7, 1996.

Shri S. Setty, Vice President of CMC Ltd. Banglore, February 7, 1996.

Shri Prafulla Maheswari, Managing Editor, Nav Bharat and Secretary General, Federation of M.P. Chambers of Commerce & Industry, February 7, 1996.

Shri K. Sankaranarayanan, Principal Secretary Deptt. of Commerce & Industry, February 7, 1996.

Prof. Eddie James University of Herfordshire, Herts, U.K., February 13, 1996.

Shri Iftikar Ahmed, M.D., Bhopal Gelaltin Factory, February 15, 1996.

Mrs. Tinoo Joshi, Director, Rajiv Gandhi Gramodyog Mission, Govt. of M.P. February 19, 1996.

Shri S. Dutta, Chief Engineer, MECON, Ranchi, February 28, 1996.

Dr. H. Kudo, Dr. H. Sekiguchi, K. Kikuchi, Dr. T. Sano, Dr. K. Shinozaki, Japanese delegation as a part of AIST-CSIR Workshop on Precision Forging and Forming, March 1, 1996.

A Japanese delegation visited RRL in connection with formulation of projects on precision forging and forming

Dr. B.N. Das, Scientist, Naval Research Laboratory, Washington DC, USA, March 6-9, 1996.

Dr. T. Ramaswamy, Director, Central Leather Research Institute, Madras, March 7, 1996.

Dr. R.K. Bhandari, Head, ISTAD, CSIR, New Delhi, March 12-13, 1996.

APPENDIX-4

RESEARCH PAPERS AUTHORED BY RRL SCIENTISTS

1. **R. Bhima Rao, T.G. Charan, S. Prakash, K.S. Narasimhan and T.C. Rao**, "Grinding aids for energy conservation : A case study on grindability of iron ore", IE (I) Journal-MN, 76, 6-8, 1995.
2. **D.D. Haldar, N. Suresh and T.C. Rao**, Effects of some process variables of conditioning on the coal-oil agglomeration of middlings", IE (I) Journal-MN, 76, 9-14, 1995.
3. **N. Suresh, R. Venugopal and T.C. Rao**, Prediction of performance of 76-mm compound autogenous cyclone at different outlet diameters, Transactions of the Institution of Mining and Metallurgy, Section C, Mineral Processing and Extractive Metallurgy, 104, C30, 1995.
4. **A.K. Majumdar, B. Govindarajan, T. Sharma, H.S. Ray, T.C. Rao**, "An empirical model for chloridising-roasting of potassium in glauconitic sandstone", Int. J. Miner. Process., 43, 81-89, 1995.
5. **R. Dasgupta and S.K. Bose,** "Effect of copper on the tribological properties of Aluminium-Silicon base alloys", Journal of Materials Science Letters, 14, 1661-1663, 1995.
6. **C.N. Pathak and A.K. Gupta**, "Foundary slags for production of glass-ceremics", Transaction the Institute of IndianFoundrymen, 316-317, 1995.
7. **R. Dasgupta, S.P. Narayan and S.K. Bose**, "Hard ferrites from bluedust of Bailadila iron ore mines of Madhya Pradesh", Research and Industry, 40, 236-239, 1995.
8. **R. Bhima Rao, K.S. Narasimhan and T.C. Rao**, "Effect of grinding aids on liberation of gangue mineral from ore", Proceedings of a conference on mineral processing - recent advance and future trends, 244, 1995.
9. **T.C. Rao**, "Improvement of plant performance : A few Indian case studies", Proceedings of a Int. conference on mineral processing - recent advances and future trends, Eds. S.P. Mehrotra and R. Shekhar, Allied Publishers, New Delhi, 299, 1995.
10. **Kiran Singh and Aparna Chauhan**, "Uptake of cadmium by bacillus subtilis f", Cientifica, 38, 25-28, 1995.
11. **K.K. Rao, C. Padmakar and L.S. Rao**, "Petrographic liberation studies of glauconitic sandstone of Majhgawan area, Satna Dist. M.P.", The Indian Mining & Engineering Journal, 34, 1, 10-14, 1995.
12. **P. Prabha, S.R. Patnaik and C.B. Raju**, "Flyash and its utilisation in industry and agriculture land development", Research and Industry, 40, 8, 1995.
13. **P. Prabha, C.B. Raju and A.S. Rao**, "Characteristics of flyash to asses its suitability for Agriculture", Clay Research, 13, 30-37, 1995.
14. **R. Dasgupta and S.K.Bose**, "Relating the debye temperature and structural stability of rapidly solidified aluminium alloys", Journal of Metals, 47, 20-24, 1995.
15. **P. Asokan, M. Saxena, S.K. Bose and A.C. Khazanchi**, "Bulk utilization of flyash for wasteland development", published in the proceeding Workshop on Flyash Management in the State of Orissa, jointly organised by RRL Bhubaneshwar and Orissa Environmental Programme Indo-Norwegian Development, Bhubaneswar, 64-75, 1995.

16. **B.K. Prasad, S. Das, A.K. Jha, O.P. Modi, R. Dasgupta and A.H. Yegneswaran**, "Zinc-Aluminium alloys : A cost and energy effective substitute for bronzes", Proceedings of the XI National Convention of Mechanical Engineers : Tribology for Energy Conservation in Industries, The Institution of Engineers (I), Bhopal, M1-M9, 1995.

17. **A.K. Jha, B.K. Prasad, S. Das, O.P. Modi, R. Dasgupta and A.H. Yegneswaran**, "Enquiries into the white layer formation for energy conservation", Ibid, M10-M16, 1995.

18. **S. Das, A.K. Jha, B.K. Prasad, S.B. Singh, O.P. Modi and R. Dasgupta**, "RESCA -A new material for automobile brake drum",Ibid, M28-M34, 1995.

19. **R. Dasgupta, B.K. Prasad, O.P. Modi, S. Das, A.K. Jha, and A.H. Yegneswaran**, "Improved Performance of Agricultural Implements through Surface Modifications - Some Case Studies", Ibid.

20. **R.Dasgupta and S.K. Bose**, "Effect of nickel on the thermal stability of rapidly solidified aluminium-nickel alloys", Ibid.

21. **B. Chakradhar, S.N. Kaul, and G.D. Nageswar**, "Bio-energy recovery from pulp processing waste water", J. Environ. Sci. Health, A30(5), 971-979, 1995.

22. **L.S. Rao, J.P. Barnwal, B. Govindarajan, S.D. Prasad and T.C. Rao**, "Studies on beneficiation of pyrite cinder from Amjhore, Bihar", Trans. IIM, 48, 2, 129-132, 1995.

23. **B.K. Prasad, A.K. Jha, O.P. Modi, S. Das and A.H. Yegneswaran**, "Abrasive wear characteristics of a Zn-37.2 Al- 2.5 Cu-0.2 Mg alloy dispersed with silicon carbide particles", Materials Transactions of Japan Institute of Metals, 36, 8, 1048-1057, 1995.

24. **I.B. Singh, S. Sultan and K. Balakrishnan**, "Cathodic process on iron in $NaNO_3$ and KNO_3 melts", Electrochim. Acta, 40, 1755-1759, 1995.

25. **M. Saxena and A. Roy**, "Development of Sisal Handicrafts in Madhya Pradesh : A prosperous future" Udhyamita, 31-34, 1995.

26. **I.V. Suresh, A. Wanganeo, M.V.R.L. Murthy, S.K. Sanghi and R.N. Yadava**, "Impact of storm water run-off on efficiency of the effluent treatment plant - A case study", Journal of Environmental Sciences and Health, Part-A, Environmental Sciences and Engineering, 13, 4, 1995.

27. **C.B. Raju, J. James and T.C. Rao**, "Ceramic powders for High-tech Applications", Ed. B.V.S.S. Rao, Universities Press, Hyderabad, 65-70, 1995.

28. **R.S. Solanki, V.S. Muneshwar and B.K. Saxena**, "Life assessment and life extention programe for critical power plant structures", Proceeding of Workshop on Performance evaluation and condition assessment in power plant and process industries, CPRI, Nagpur, 33-44, 1995.

29. **I.B. Singh**, "Enfluence of moisture on the corrosion rate of iron in $NaNO_3$ and KNO_3 melts", Corros, Sci., 37, 1981-82, 1995.

30. **Navin Chand and R.P. Soni**, "Strength behaviour of some fibre-reinforced polymide composites", Research and Industry, 40, 5-7, 1995.

31. **Navin Chand and S.K. Joshi**, "Effect of Y-irradiation on dc conductivity of sisal fibres", Research and Industry, 40, 121-123, 1995.

32. **Navin Chand and S.A.R. Hashmi**, "Thermal analysis of redmud particles filled LDPE", Research and Industry, 40, 124-127, 1995.

33. **Navin Chand and M. Fahim**, "Abrasive wear behaviour of some GRP composites", Research and Industry, 40, 182, 1995.

34. **Navin Chand and S.A.R. Hashmi**, "Mechanical and rheological characteristics of PP/PE/redmud composites", Research and Industry, 40, 193-202, 1995.

35. **N.G. Hung and Navin Chand**, "Structure and wear characteristics of graphite ultra high molecular weight polyesthylene composite", Research and Industry, 40, 297, 1995.

36. **Navin Chand and M. Fahim**, "Role of polymeric matrices in improving wear resistance of irradiated FRP composite", Tribology Letters, 1, 301-307, 1995.

37. **S.A.R. Hashmi and N. Chand**, "SEM observations of tensile fractographs of redmud filled linear low density polyethylene", J. of Mat. Sc. lett., 14, 377-379, 1995.

38. **Navin Chand, J.C. Kaerger and G. Hinrichsen**, "Comparison of strenght and modulus behaviour of unidirectional carbon fibre composties", J. Sci. & Indust. Research, 55, 277, 1996.

39. **R. Dasgupta and S.K. Bose**, "High temperature stability of rapidly solidified Al-Mn-Ni alloys", Journal of Materials Science Letters, 15, 366-367, 1996.

40. **T.C. Rao**, "R&D studies on beneficiation of some typical Indian ores", Broad Perspective in Metallurgy and Related Field, IIM, Udaipur, Chittorgarh Chapters, 134, 1996.

41. **S. Das, A.K. Jha, B.K. Prasad, O.P. Modi, R. Dasgupta and A.H. Yegneswaran**, "Three-body abrasive wear of austenitic manganese steels", Proceedings of the International Seminar on Industrial Tribology (Tribo Tech-96), Jamshedpur, 1996.

42. **R.S. Solanki, V.S. Muneshwar and B.K. Saxena**, "Life extention for critical power plant structures", published in proceedings of 3rd International Conference on power generation transmission and distribution in Afro-Asian countries, Kathmandu, Nepal Electricity Authority, Kathmandu, 310-317, 1996.

43. **M. Saxena, P. Asokan, S. Srimanth, S. Mandal and A. Chauhan**, "Bulk Utilization of fly ash for wasteland development", 1613-1616, Ibid.

44. **M. Saxena, P. Asokan, S.R. Karade, S. Srimanth, A. Chauhan and S. Mandal**, "Effect of fly ash on the mobility of nutrients of black cotton soil", 1621-1624, Ibid.

45. **M. Saxena, S.R. Karade and R.K. Morchhale**, "Development of flyash based composite material", 1642-1646, Ibid.

46. **P. Asokan, M. Saxena, S. Srimanth, M. Sangeeta and Aparna Chauhan**, "Use of fly ash for conditioning waste land soil to increase its fertility", published in the proceeding of National Seminar on Flyash Utilization organised by CBIP, New Delhi, Ed. C.V.J. Verma, published by CBIP, V1-V4, 1996.

47. **Prabha Padmakaran and C.B. Raju**, "Studies on leaching rates of extractables ions from flyash and its utilization", IV-27, Ibid.

APPENDIX-5

PAPERS PRESENTED BY RRL SCIENTISTS

1. **T. Sorna Gowri**, "Enhancement of durability of bamboo by surface modification", Seminar on Bamboo Utilisation at MACT, Bhopal, April 25-26, 1995.
2. **P. Asokan, Mohini Saxena, Srimanth, Aparna Chauhan and M. Sangeeta**, "Pilot scale implementation on use of flyash to improve the soil fertility and increase the crop yield", Workshop on Ash Utilization, jointly organised by Power Management Institute, NTPC, Noida and E7 Group Canada, Japan, Italy, France and Germany at NTPC, Noida, July 25-27, 1995.
3. **R. Dasgupta, B.K. Prasad, O.P. Modi, S. Das, A.K. Jha and A.H. Yegneswaran**, "Improved performance of agricultural implements through surface modification - Some case studies", 33rd National Metallurgists' Day and 49th Annual Technical Meeting of the Indian Institute of Metals held at Calcutta, November 14-17, 1995.
4. **R. Dasgupta and S.K. Bose**, "Effect of nickel on the thermal stability of rapidly solidified aluminium-nickel alloys", Ibid.
5. **R.S. Ahirwar, S.K. Bose, A.C. Khazanchi and R.K. Chouhan**, "Reaction of redmud, rice husk and clay", Ibid.
6. **O.P. Modi, A.K. Jha, A.H. Yegneswran and M.L. Vaidya,** "Material removal mechanism during two-body abrasion of a cast Al-Cu2014 alloy aluminium particulate composite", Ibid.
7. **A.K. Majumdar, M. Prasad, G.M. Rao and T.C. Rao**, "Prospects of utilisation of low grade siliceous rock phosphate", Ibid.
8. **O.P. Modi, A.K. Jha, B.K. Prasad, S. Das and A.H. Yegneswaran**, "Al-Cu-SiC composites : microstructure and sliding wear behaviour", Ibid.
9. **O.P. Modi, A.K. Jha, B.K. Prasad, S. Das, R. Dasgupta and A.H.Yegneswaran**, "Metallurgical investigations in failure of thermal power plant components - typical case studies", Workshop on Performance Evaluation and Condition Assessment in Power Plants and Process Industries, Nagpur, November 23- 24, 1995.
10. **V.S. Muneshwar and A.H. Yegneswaran**, "Performance evaluation of process industry components through NDT approach", Ibid.
11. **A.K. Jha, B.K. Prasad, S. Das, O.P. Modi, Rupa Dasputa and A.H. Yegneswaran**, "Enquiries into white layer formation for energy conservation", XI National Convention of Mechanical Engineers on Tribology for Energy Conservation in Industries, organised by Institution of Engineers (India), M.P. State Centre Bhopal at MACT, Bhopal, November 25-26, 1995.
12. **B.K. Prasad, S. Das, A.K. Jha, O.P. Modi, Rupa Dasgupta and A.H. Yegneswaran**, "Zinc-Aluminum alloys : A cost and energy effective substitute for bronzes", XI National Convention of Mechanical Engineers on Tribology for Energy Conservation in Industries, organised by the Institution of Engineers (India), M.P. State Centre Bhopal at MACT, Bhopal, November 25-26, 1995.
13. **S. Das, A.K. Jha, B.K. Prasad, O.P. Modi, R. Dasgupta and A.H. Yeneswaran**, "RESCA - A New Material for automobiles", Ibid.

14. **Aparna Chauhan and Kiran Singh**, "Accumulation of the flyash components by the Microbes isolated from flyash", at Cochin, December 11-13, 1995.

15. **B. Tirupati, B. Chakradhar, M.V.R.L. Murthy and R.N. Yadava**, "Groundwater contamination due to hazardous waste dumping site and its management", Training programme for World Bank aided project at Disaster Management Institute, Bhopal, December 11-15, 1995.

16. **B. Chakradhar, M. Mudgal, U. Agnivesh and D. Dawar**, "Hazardous Wastes: their nature and potential environmental hazards", Disaster Management Institute, Bhopal, December 14, 1995.

17. **B. Chakradhar, M. Mudgal, I.B. Singh and D. Dawar**, "Methodology for Risk Assessment of Hazardous waste dumping site", Disaster Management Institute, Bhopal, December 15, 1995.

18. **B. Chakradhar, M.V.R.L. Murthy and T.C. Rao**, "Energy recovery from industrial effluents using Anaerobic systems", MPCON, Bhopal, December 15, 1995.

19. **T.C. Rao, J.P. Barnwal and B. Govindarajan**, "Industrial Application of Vorsyl separator", Foundation Conference on Particle Science & Technology in the 21st Century, TRDDC, Pune, December 18-21, 1995.

20. **I.B. Singh**, "Effects of concentration and temperature on the corrosion of Ni-based alloys in aqueous acidic environment",6th National Convention of Electrochemists, CECRI, Karaikudi, December 20-22, 1995.

21. **W.Th. Kok, S.K. Sanghi, M.V. Bruijnsvoort and H. Poppe**, "Determination of Chlorophenols in water samples by capillary electrophoresis with electrochemical detection", International Conference HPCE 1996 Symposium, Orlando, Fl, USA, January 21-25, 1996.

22. **R. Dasgupta, B.K. Prasad, O.P. Modi, S. Das, A.K. Jha and A.H. Yegneswaran**, "Avenues to improve the performance of agricultural implements through surface modification", Tenth National Convention of Agricultural Engineers : Role of Agricultural Machinery for Sustainable Economy, Institution of Engineers (I), Bhopal, February 10-11, 1996.

23. **R. Dasgupta, B.K. Prasad, O.P. Modi, S. Das, A.K. Jha and A.H. Yegneswaran**, "Performance evaluation of surface modified agricultural implements", Ibid.

24. **M. Saxena, P. Asokan, S. Srimanth and Aparna Chauhan**, "Industrial wastes utilization for wasteland development", International Conference on Mineral and Metallurgical Industrial Waste Utilization (MIMIWU-96) at Bhubaneswar, February 22-24, 1996.

25. **S. Das, A.K. Jha, B.K. Prasad, O.P. Modi, R. Dasgupta and A.H. Yegneswaran**, "Three-body abrasive wear of austenitic manganese steels", International Seminar on Industrial Tribology (Tribo Tech-96), Jamshedpur, February 23-24, 1996.

26. **A.H. Yegneswaran, O.P. Modi, B.K. Prasad, S. Das and Rupa Das Gupta**, "Improving physical, mechanical and tribological properties of Al-alloy particulate composites and ZA-alloy through permitted sophisticated and secondary processes techniques", AIST-CSIR Workshop on Precision Forging and Forming, NPL, New Delhi, February 26-29, 1996.

27. **M. Saxena, S.R. Karade and R.K. Morchhale**, "Development of flyash based composite materials", 3rd International Conference on power generation transmission and distribution in Afro-Asian countries, Kathmandu (Nepal), March 4-7, 1996.

28. **A. Chauhan**, "Copper accumulation by the microbes isolated from fly ash" - A thermal power industrial waste, Ibid.

29. **T.C. Rao**, "Plant performance studies", Interactive meeting on waste utilisation from minerals and mineral based industries (WUMMBI-95), RRL, Bhubaneswar.

30. **C.N. Pathak**, "Soil reaction on duckfoot sweeps in black cotton soil", ASME 31st Annual Convention 1995, TNAU, Coimbatore.

31. **R.S. Ahirwar, A.C. Khazanchi and J. Prabakar**, "Evaluation of red mud cementitious binder as a masonry cement", Interative meet on processing of Indian Bauxite and Alumina : A Problem and Prospects (BAUXAL-96).

32. **J. Prabakar, R.S. Ahirwar and Mohini Saxena**, "Use of red mud in prototype houses construction at RRL, Bhopal : A case study", Ibid.

33. **R.K. Morchhale, M. Saxena and S.R. Karade**, "Red mud polymer composite as a substitute of wood", Ibid.

34. **P. Asokan, M. Saxena, S. Srimanth, Aparna Chauhan and S. Mandal**, "Reactivity of coal ash in clay soil", Ibid.

35. **P. Asokan, M. Saxena, S. Srimanth, A. Chauhan and S. Mandal**, "Effect of flyash component with its bulk application on vegetation", Ibid.

36. **P. Asokan, M. Saxena, A. Chauhan and S. Mandal**, "Flyash utilization in wasteland development", International Conference on Flyash Utilizaion, CBIP, New Delhi.

37. **P. Asokan, M. Saxena, S. Mandal and A. Chauhan**, "Sustainable development on flyash application in agronomic aspects : Traditional sciences and technologies of India", Ibid.

38. **M. Saxena, P. Asokan, S. Srimanth, A. Chauhan and S. Mandal**, "Solid waste management and sustainable development on flyash use in agricultural production", Ibid.

LECTURES

Invited Lectures by Experts

Prof. P.N. Misra, MACT, Bhopal, "Scope of steel metal working", June 23, 1995.

Dr. G. Thyagarajan, Former Director, Central Leather Research Institute, Madras, "New economic reforms and R&D systems", June 27, 1995.

Prof. Rajput, MACT, Bhopal, "Importance of forging", June 30, 1995.

S. Khuntia, Scientist, RRL, Bhubaneswar, "Rural development programme at RRL, Bhubaneswar", July 25, 1995.

Dr. Nawab Ali, Project Director, Central Institute of Agricultural Engineering, Bhopal, "Soya food", August 25, 1995.

Dr. G.S. Sidhu, Ex. DGSIR, "The changing environment for research and development in India", September 26, 1995.

G.D. Limaye, Director, Goraj Management Consultants, Bhopal, "Creativity in R&D management", October 13, 1995.

Dr. Chandra Gupt, Scientist, Computer Division, CSIR, New Delhi, "Computer networking and rennic", October 27, 1995.

N.R. Subbaram, CSIR, New Delhi, "Intellectual property management new CSIR initiatives", November 13, 1995.

Dr. Eric Forssberg, Professor, Lnlea University of Technology, Lnlea, Sweden, "Processing Industrial Minerals", December 7, 1995.

Thomas J. Cova, Researcher, National Center for Geographic Information and Analysis (NCGIA), Department of Geography, University of California, Santa Barbara, USA, "Geographic Information System (GIS) in Regional Evacuation Anaylsis", December 13, 1995.

G.D. Limaye, Director, Goraj Management Consultants, Bhopal, "Executive Programme on Time Management", January 12 & 19, 1996.

Prof. D.D. Kale, UDCT, Bombay, "Rheological aspects of polymer processing", January 23, 1996.

Prof. L.A. Utracki, National Research Council, Canada, "Polymer blends", January 23, 1996.

Dr. V.N. Misra, Director & Professor, Department of Minerals and Energy, Mineral Processing Laboratory, Western Australia School of Mine, Australia, "Opportunity of iron ore processing in Western Australia", January 24, 1996.

Prof. Eddie James, University of Hertfordshire, U.K., "Project Identification and Tools for Rapid Rural Appraisal for Watershed Development", February 20, 1996.

Lecture delivered by RRL staff

Dr. B.K. Prasad, "Regional Research Laboratory at a glance : research and development facilities and activities", at Karpenko Physico Mechanical Institute, Lviv, Ukraine, April 5, 1995.

S.P. Narayan, "Deformation induced anisotropy in Nd-Fe-B magnets", organised by IIM, Bangalore Chapter at IISc, Bangalore, April 6, 1995.

Dr. B.K. Prasad, "Some aspects of tribological property characterization of materials", at Karpenko Physico Mechanical Institute, Lviv, Ukraine, April 6, 1995.

P. Asokan, "Flyash utilisation in agriculture" at NALCO, Bhubaneswar, April 13, 1995.

S.K. Bose, "Relating debye characteristic temperature with the stability of RSP aluminium based alloys", at NML, Jamshedpur, April 17, 1995.

Dr. S. Das, "Interfaces in metal matrix composites" at Technical University of Berlin, Germany, June 12, 1995.

Dr. S. Das, "Aluminium alloy matrix particle composites" at Fraun Hofer Institute for Applied Materials Research, Department for Powder Metallurgy and Composite Materials, Dresden, Germany, June 19, 1995.

Dr. S. Das, "Aluminium alloy matrix composites : Recent developments at RRL Bhopal", at Technical University of Clausthal, Germany, June 28, 1995.

Dr. B.K. Prasad, "Crystal structure and imperfections", ISTE Summer School at MACT, Bhopal, July 10-22, 1995.

Dr. B.K. Prasad, "Wear processes in and characterization of materials", Ibid.

Dr. Rupa Dasgupta, "X-Ray diffraction", Ibid.

Dr. A.K. Jha, "Electron microscopy", Ibid.

Dr. A.K. Jha, "Characterisation of powders", Ibid.

Dr. A.H. Yegneswaran, "Creep testing", Ibid.

Dr. A.H. Yegneswaran, "Mechanical testing", Ibid.

Dr. S. Das, "Mechanical properties of metals and alloys", Ibid.

Dr. S. Das, "Fatigue behaviour of metals and alloys", Ibid.

Dr. S. Das, "Metal matrix composites", Ibid.

Dr. O.P. Modi, "Failure analysis and case studies", Ibid.

Dr. O.P. Modi, "Optical microscopy", Ibid.

Dr. C.B. Raju, "Characterisation of ceramic raw material and advanced ceramics", Ibid.

S.P. Narayan, "Characterization of magnetic properties", Ibid.

Dr. R.N. Yadava, Hydrology and Water Resources Seminar "Groundwater management : A case study in Madhya Pradesh in India" at University of Arizona, Tucson, Arizona, October 11, 1995.

Dr. R.N. Yadava, Special Hydrology Seminar on "Water resources management in waterlogged areas and droughtprone areas in India : A case study for the State of Madhya Pradesh" at Department of

Geoscience, Earth & Environmental Sciences, Institute of New Mexico Tech, New Mexico, October 12, 1995.

Dr. R.N. Yadava, "Natural resource management for sustainable development : cooperative research opportunities at RRL, Bhopal" at Department of Earth Sciences, University of Waterloo, Canada, October 31, 1995.

Dr. R.N. Yadava, "Groundwater resources management through modelling" at Department of Geology, University of Wisconsin, Oshkosh, November 17, 1995.

Dr. R.N. Yadava, "Modelling of composites reinforced with micro-baloon", Seminar sponsored by UWM Center for Composites and Materials Department at University of Wisconsin, Milwaukee, November 20, 1995.

R.S. Solanki, "Life assessment and life extention programe for critical power plant structures", at Nagpur, November 23, 1995.

B. Tirupati, "Groundwater contamination due to hazardous waste dumping site and its management", Training course on Hazardous Waste Management, at Disaster Management Institute, Bhopal, December 13, 1995.

Dr. B. Chakradhar, "Energy recovery from industrial effluents using anaerobic systems, MPCON, Bhopal, December 15, 1995.

Dr. B. Chakradhar, "Recycling, reclamation and waste reduction techniques", Training course on Hazardous Waste Management, at Disaster Management Institute, Bhopal, December 15, 1995.

I.B. Singh, "Effects of concentration and temperature on the corrosion of Ni-based alloys in aqueous acidic environment", 6th National Convention of Electrochemists, CECRI, Karaikudi, December 20-22, 1995.

Dr. B.K. Prasad, "Zinc-Aluminium alloys : A potential material for bearing applications", at Vehicle Factory, Ministry of Defence, Jabalpur, December 22, 1995.

Dr. A.H. Yegneswaran, "R&D activities at RRL, Bhopal", Ibid.

Dr. S. Das, "Aluminium alloy composites for automobile components", Ibid.

P.D. Ekbote, "Technologies from RRL, Bhopal", at National Workshop on Technologies of Tomorrow arranged by SISI, Indore at Bhopal, January 5-6, 1996.

Dr. Mohini Saxena, "Sisal Fibre Products", Six-day Awareness Programme on "Technology for Tomorrow for SC/ST Target Group" Jointly organised by M.P. Council of Employment and Training, Bhopal and the Centre for Entrepreneurship Development Madhya Pradesh, Bhopal at Central Bank's Officer Training College, Bhopal, March 25-30, 1996.

Internal Seminars

Dr. C.B. Raju, "Silicon carbide whiskers from rice hulls", April 21, 1995.

S.A.R. Hashmi, "Polymer composites", April 28, 1995.

Dr. I.B. Singh, "Fused salt induced hot corrosion", May 5, 1995.

Dr. Kunal Basu, "Development of retainer ring for use in high voltage, high speed squirrel cage to pole AC machines", May 26, 1995.

S.K. Bose, "Specific heat a parameter for thermal stability of RSP aluminium alloys", June 2, 1995.

Dr. S.S. Amritphale, "Preparation of active MnO_2 using micro wave heating", June 9, 1995.

R.S. Ahirwar, "Present status of prototype houses construction at RRL", June 16, 1995.

P. Asokan, "Fly ash in agricultural production", July 7, 1995.

Dr. T.S. Balasubramaniam, "Introducing aircrafts", July 14, 1995.

Dr. J.P.Barnwal, "Fine coal cleaning", July 21, 1995.

K. Udaya Bhaskar, "Efficient reduction for graphite in lead ore", July 28, 1995.

Dr. B. Chakradhar, "Environmental studies for industrial pollution control", August 11, 1995.

Dr. S. Das, "Al alloy matrix particle composite : current development in industrial research and development", September 8, 1995.

K.K.S. Gautam, "Protection and safety from radiation in medical diagnostic X-ray", September 22, 1995.

Dr. A.K. Gupta, "Tillage forces on duck foot sweeps", September 29, 1995.

M.S. Yadav, "Processing of semi conductors", October 6, 1995.

Dr. Rupa Dasgupta, "Improvement in performance of farm implements", October 20, 1995.

Dr. B. Govindrajan, "Quantification of sink float data", November 3, 1995.

P.D. Ekbote, "Technology management", November 17, 1995.

S.A.R. Hashmi, "Dynamic viscoelastic behaviour of polyblend melts", December 1, 1995.

Dr. O.P. Modi, "Metallurgical investigation into failure of Thermal Power Plant Components", December 8, 1995.

Dr. Navin Chandra, "Pollution control of industrial heavy metal ions", December 15, 1995.

Dr. A.K. Jha, "Electron microscopy", January 5, 1996.

Alka Meshram, "Use of sisal fibre in building applications", March 29, 1996.

Patent Applications

1. A process for squeeze casting of near-net-shape component.
2. A process for the preparation of aluminium nitride (AIN) whiskers.
3. A process for the production of floor tiles from foundry cupola slag.
4. A process for the manufacture of aluminium alloy composites reinforced with hard particles.
5. A process for casting thick and long PMMA cone/cylinder.
6. A composition useful as a coating for improvement of corrosion and stick resistance of steel.
7. A novel highly energy efficient process for making some value-added products viz. ceramic tiles for building application utilising glauconitic sandstone.
8. Development of zinc-based alloy bushes for slow moving heavy duty applications.
9. A process for the preparation of tiles and slabs from waste slag of foundry cupola using cement binders.

10. A process for the preparation of fired tiles and slabs from waste slag of foundry cupola using clay.
11. Development of aluminium alloy-silicon carbide particle composite brake drum for automobiles.
12. A process for melt blending of incompatible non-interacting polymers into homogeneous mixture.
13. An improved process for the preparation of Beta-silicon carbide whiskers.
14. Development of investment preforms and moulding process for ferrous and non-ferrous castings.
15. A Novel process for minimization of zinc loss during oxidizing roasting of zinc ash.

APPENDIX-7

SEMINARS/WORKSHOPS/CONFERENCES ATTENDED BY RRL STAFF

1. **B.N. Dikshit and Ms. Manisha Dubey**, attended the "Intercouncil Workshop of Hindi Officers" at CSIO, Chandigarh, April 6-7, 1995.
2. **Dr. S.K. Sanghi**, attended a Symposium on "Development in Sample Handling in Environmental analysis" at University of Antwerpen, Antwerpen, Belgium, April 20, 1995.
3. **Dr. S.K. Sanghi**, attended a Workshop on "Advance Detection for Positive Compound Identification"at University of Utrecht, Utrecht, Netherlands, April 28, 1995.
4. **P.D. Ekbote and Dr. B. Chakradhar**, attended Conselling Meeting for Awardees of M.P. Young Scientists' Award at MPCST, Bhopal, May 6-8, 1995.
5. **Dr. M.V.R.L. Murthy, Dr.(Mrs.) Arati Roy and B. Tirupati**, attended the National Conference on "Perspectives and Current Trends in Information Technology" jointly organised by Computer Society of India, Bhopal Chapter and MACT at MACT, Bhopal, June 25-26, 1995.
6. **Dr. Kunal Basu**, attended Workshop on "Role of composites in industry" at Pune, June 29, 1995.
7. **Dr. B. Chakradhar**, attended "Application of remote sensing and GIS in Decentralised planning and forestry, ground water and desertification", July 6, 1995.
8. **Dr. S.K. Sanghi**, attended a summer course on "High performance liquid chromatography" at University of Amsterdam, Netherlands, July 10-14, 1995.
9. **Dr. B. Chakradhar**, attended "Workshop Conflict Revolution on Bio-diversity Conservation", WWF, CEL, EPCO (India), July 27, 1995.
10. **P.D. Ekbote**, attended a Workshop on "Management of technology" organised by M.P. Science & Technology Entrepreneurship Park at MACT, Bhopal, July 27-29, 1995.
11. **P. Asokan and M. Saxena**, atteded Workshop on "Ash Utilization", jointly organised by Power Management Institute, NTPC, Noida and E7 group Canada, Japan, Italy, France and Germany at NTPC, Noida, July 25-27, 1995.
12. **P. Asokan and M. Saxena**, attended Entrepreneurship programme organised by Udyamita Vikas Kendra, Bhopal, August, 1995.
13. **V.S. Muneshwar, Dr. Rupa Dasgupta and B. Kujur**, attended a National Workshop on "Role of Metrology in Total Quality Management" organised by Department of Physics, Barkatullah University, Bhopal, August 18-19, 1995.
14. **Prof. T.C. Rao, Dr. Kunal Basu, S.P. Narayan and D. Mondal**, attended Seminar on "A World on the Move - International Standards Help Transport People, Energy, Goods and Data" on World Standards Day organised by Bureau of Indian Standards, BHEL, Bhopal and Institute of Standards Engineers at BHEL, Bhopal, October 14, 1995.
15. **Dr. B. Chakradhar**, attended "Workshop on Energy Recovery from Industrial Waste by using Anaerobic Treatment Technique", MPCON, October 14-15, 1995.
16. **Dr. B. Chakradhar**, attended "National think-tank on environment audit for the 21st century-practical strategies and future directions" at Goa, October 28-29, 1995.

17. **Prof. T.C. Rao, Dr. Navin Chandra, Dr. Navin Chand, P.D. Ekbote, Dr.(Ms.) M. Saxena, Dr. M.V.R.L. Murthy and B. Tirupati**, attended Programme on "Establishment of M.P. Academy of Sciences" organised by M.P. Council of Science & Technology, Bhopal, November 14, 1995.

18. **Raghuvanshi Ram** attended "Exploration Geophysics" at GSI, Calcutta, November 14-16, 1995.

19. **Dr. O.P. Modi, Dr. A.K. Jha, Dr. B.K. Prasad and Dr. Rupa Dasgupta**, 33rd National Metallurgists' Day & 49th Annual Technical Meeting of the Indian Institute of Metals, Calcutta, November 14-17, 1995.

20. **Dr. O.P. Modi, R.S. Solanki and V.S. Muneshwar**, Workshop on "Performance Evaluation and Condition Assessment in Power Plants and Process Industries", Nagpur, November 23-24, 1995.

21. **Dr. A.H. Yegneswaran, Dr. S. Das, Dr. B.K. Prasad, Dr. A.K. Jha, Dr. O.P. Modi, Dr. A.K. Gupta, Dr. Rupa Dasgupta, M.S. Yadav, K. Venkat, J.P. Pandey and T.S.V.C. Rao**, attended XI National Convention of Mechanical Engineers : Tribology for Energy Conservation in Industries, The Institution of Engineers (I), Bhopal, November 25-26, 1995.

22. **Prof. T.C. Rao and P.D. Ekbote**, attended Ninth National Conference on "In-house R&D in Industry" at New Delhi, November 28-29, 1995.

23. **Dr.(Ms.) M. Saxena and Dr. Arati Roy**, attended one day consultation meeting on "National Policy Women" organised by Ministry of Human Resource Development, Department of Women and Child Development at Academy of Administration, Bhopal, December 2, 1995.

24. **P.D. Ekbote**, attended Annual Business Meeting of CSIR Marketing Personnel at CFTRI, Mysore, December 7-8, 1995.

25. **Dr. B. Govindarajan, Dr. J.P. Barnwal, Dr. D.P. Patil and K. Udaya Bhasakar**, International Mineral Processing Conference- Recent Advances & Future Trends at IIT, Kanpur, December 11-15, 1995.

26. **Dr. Arati Roy, Dr. A.K. Gupta and V.S. Muneshwar,** attended 40th Annual Congress of "Indian Society of Theoretical and Applied Mechanics", MACT December 14-17, 1995.

27. **S.P. Narayan**, attended the International Conference on "Perspectives on Materials Science" organised by IIM, MRSI, NRL (USA) and others at Bangalore, December 18-20, 1995.

28. **Prof. T.C. Rao and Dr. J.P. Barnwal**, attended Engineering Foundation Conference on "Particle Science & Technology in the 21st Century", at TRDDC, Pune, December 18-21, 1995.

29. **P.D. Ekbote and Dr. M.V.R.L. Murthy**, Sixth National Water Convention-96 held at Bhopal, January 4-5, 1996.

30. **Dr. (Ms.) M. Saxena**, "Use of Bamboo Composite in Building Application" Workshop on Bamboo and Rattan held on Jan. 1996 at Indira Gandhi Rashtriya Manav Sagrahalay Campus.

31. **R.S. Solanki and Dr. (Ms.) M. Saxena**, attended "Afro-Asian 3rd International Conference", Kathmandu, February 5, 1996.

32. **I.B. Singh**, attended "Awareness camp on fluorosis", PHED, Bhopal, February 8, 1996.

33. **Dr. Rupa Dasgupta, Dr. B.K. Prasad, Dr. O.P. Modi, Dr. S. Das, Dr. A.K. Jha, M.S. Yadav and Dr. A.H. Yegneswaran**, attended Tenth National Convention of Agricultural Engineers : Role of Agricultural Machinery for Sustainable Economy, Institution of Engineers (I), Bhopal, February 10- 11, 1996.

34. **Dr. O.P. Modi and Dr. A.K. Gupta**, attended International Conference on "Shot peening and blast cleaning", MACT, Bhopal, February 22-23, 1996.

35. **Dr. S. Das**, attended International Seminar on "Industrial Tribology (Tribo Tech-96)", Jamshedpur, February 23-24, 1996.

36. **Dr. A.H. Yegneswaran and Dr. (Ms.) Rupa Dasgupta**, attended AIST-CSIR Workshop on "Precision forging and forming" at NPL, New Delhi, February 26-29, 1996.

37. **Dr. A.H. Yegneswaran and Dr. (Ms.) Rupa Dasgupta**, attended Workshop on "Commercialisation of Surface Modification Technologies" organised by TIFAC, New Delhi, February 27-28, 1996.

38. **I.B.Singh**, attended "National Convention of Electrochemist", at Central Electrochemical Research Institute, Karaikudi.

39. **Dr. (Mrs.) Arati Roy**, attended as a Judge XI M.P. Young Scientist Congress at Rani Durgavati Vishwavidhyalay, Jabalpur, February 29-March 2, 1996.

40. **Dr. (Mrs.) Mohini Saxena and Dr. (Mrs.) Arati Roy**, attended Six-day Awareness Programme on "Technology for Tomorrow for SC/ST Target Group" Jointly organised by M.P. Council of Employment and Training, Bhopal and the Centre for Entrepreneurship Development Madhya Pradesh, Bhopal at Central Bank's Officer Training College, Bhopal, March 25- 30, 1996.

APPOINTMENT/TRANSFER

Dr. T.S.Balasubramaniam, Scientist EII (27.04.1995)	on transfer from NAL, Bangalore.
Shri S.K. Choudhary, Private Secretary (09.08.1995)	transferred to CMERI, Durgapur.
Shri Vinod Dahate, Section Officer (30.06.1995)	transferred to INSDOC, New Delhi.
Shri C.K. Mukherjee, Section Officer (01.03.1996)	transferred to CFRI, Dhanbad
Shri Sandeep Kumar Doraiburu Section Officer (28.02.1996)	new appointment

RESIGNATION

Ms. Vishakha Ramteke, Jr. Stenographer (12.10.1995)

VISITS ABROAD

Dr. B.K. Prasad, Scientist-C, visited National Academy of Sciences of Ukraine, Karpenko Physico-Mechanical Institute LVOV, Ukraine under Indo-Ukrainian Programme of Cooperation in Science & Technology, April 3-12, 1995.

Dr. S. Das, Scientist-EI, visited Federal Republic of Germany under CSIR DAAD Exchange of Scientists Programme, May 1-June 30, 1995.

Prof. T.C. Rao, Director, visited Japan as a member of the CSIR delegation to attend the first Joint Meeting between CSIR and AIST, Japan, May 30-June 3, 1995.

Dr. R.N. Yadava, Scientist-EII, visited University of California, USA under "Raman Research Fellowship Award" for study visit abroad in the area of "Geographical information system - Application to Water Resources Management", July, 1995-January, 1996.

L. Sanjeeva Rao, Scientist-B, has gone to Julius Kruttschnitt Mineral Research Centre, The University of Queensland, Australia for Ph.D. under "Australian Development Cooperative Scholarship (ADCOS) 1995 Award" offered by Australian International Development Assistance Bureau, June 26, 1995-December 4, 1998.

Dr. B. Govindarajan, Scientist-C, visited Australia, for a Training Programme on Kelsey Centrifugal Jig. He also visited Kruttschnitt Mineral Research Centre of University of Queensland.

K. Venkateshwarlu, Technical Officer, Group Training course in Non-Destructive Inspection Technique at Kyush International Centre, Japan, February 26-July 6, 1996.

AWARDS

Dr. Mohini Saxena, received the prestigious Chandaben Mohanbhai Patel Industrial Research Award for Women Scientists for 1992 function organised by Vividlaxi Audyogik Samshodhan Vikas Kendra (VASVIK), Bombay.

Dr. (Ms.) Mohini Saxena receiving the prestigious Chandaben Mohanbhai Patel Industrial Research Award for Women Scientists for 1992 from Dr. Manmohan Singh, Finance Minister

MEMBERSHIPS AND RECOGNITION

Prof. T.C. Rao

- Member, Advisory Committee for CSIR-Polytechnolgy Transfer Centre, Bhopal.
- Member, Council of Materials Research Society of India for 1995-97.
- Member, Sectional Committee-VIII for Metallurgical Engineering, Materials Science and Engineering, Mining and Geological Engineering, Indian National Academy of Engineering, New Delhi for the Session 1995-96.
- Member, Advisory Committee of "Science Tech Entrepreneur" News Letter , CEDMAP, Bhopal.
- Member, Advisory Board for Indian Bureau of Mines, New Delhi.

- Member, International Advisory Committee of "Engineering Foundation Conference on Particle Science & Technology in the 21st Century", Tata Research Development & Design Centre, Pune.
- Nominee of the Central Government, General Council and Executive Board of Indian School of Mines, Dhanbad.
- Directory of Board Members, Central Board of Irrigation and Power, New Delhi.
- Member, Standing Scientific Advisory Group (SSAG), Hindustan Zinc Limited, Udaipur.

Dr. A.H. Yegneswaran - Directory of Board Members, Central Board of Irrigation and Power, New Delhi.

Dr. Navin Chand - Fellow, Indian Plastics Institute, Bombay.

Dr. S.K. Sanghi - Member of The Royal Society of Chemistry and entitled to use the designation "Chartered Chemist".

Dr. I.B. Singh - Life Fellow, The Society for Advancement of Electrochemical Science & Technology (SAEST), Karaikudi.

HIGHER EDUCATION RELATED

Dr. R.N. Yadava - Guided Dr. Subrahmaniyam for Ph.D degree from Barkatullah University, Bhopal.

Dr. M.V.R.L. Murthy - Supervisor for Ph.D degree in Geology, Barkatullah University, Bhopal.

Dr. S.K. Sanghi - Supervisor for Ph.D. degree in Chemistry, Barkatullah University, Bhopal.

Dr. B. Chakradhar - Awarded Ph.D degree from Nagpur University, Nagpur.

Ms. Manisha Dubey - Awarded Ph.D degree from Barkatullah Vishwavidyalaya, Bhopal.

K. Venkateshwarlu - Awarded Prof. P. Banejree Memorial Best M.Tech Thesis Award, Madras.

STAFF POSITION AS ON 31.3.1996

Director		
Scientist-F	-	2
Scientist-EII	-	5
Scientist-EI	-	10
Scientist-C	-	19
Scientist-B	-	12
Technical Officer	-	5
Gr.III	-	17
Gr.II	-	11
Gr.I	-	5
Sr. Controller of Administration	-	1
Sr. Finance & Accounts Officer	-	1
Section Officer	-	3
Section Officer (F&A)	-	1
Dy. Stores & Purchase Officer	-	1
Establishment	-	33
		127
RA	-	1
QHS Fellow	-	2
SRF	-	3
JRF	-	2
Project Fellow/Project Assistant	-	27
		35